Sugar Bulletin, No. 10.

DEPARTMENT OF AGRICULTURE,
BRITISH GUIANA.

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FOREWORD.

BY

J. SYDNEY DASH,
Director of Agriculture.

FIELD EXPERIMENTS WITH SUGAR CANE, X.

BY

C. HOLMAN B. WILLIAMS,
Sugar Agronomist and Plant Breeder,

AND

C. CAMERON,
Field Manager.

THE VARIETY AND FERTILISER POSITION OF THE SUGAR INDUSTRY, VII.

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SOME PRELIMINARY EXPERIMENTS ON PHOSPHATE FIXATION IN BRITISH GUIANA SUGAR CANE SOILS.

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C. L. C. BOURNE,
Acting Chemist.

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Note:—The cost of publishing this Bulletin has been met from the funds of the Sugar Experiment Stations' Committee.

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FOREWORD.

Those who have followed our investigations will recall that twelve years ago the sugar research work of this Colony was reorganised and considerably expanded. A scheme of variety, manurial and cultural tests, both at the Experiment Station and on the sugar estates, was launched and the breeding work intensified. In all the work undertaken, the Sugar Industry and the Department of Agriculture have collaborated closely.

As the results of the trials became available it was decided to issue a Bulletin from time to time in order that those interested might be kept adequately informed. Nature cannot be hurried and agricultural research is a notoriously slow yielder of results. Nevertheless, it is felt that in several directions results of considerable value have been secured.

With the appearance of the tenth Bulletin of the series, it may not be inappropriate here to stress the immense volume of routine work which has made them possible—in this connection it should be remembered that in many circumstances a negative is as important as a positive answer, for we must know what *not* to do as well as what to do—and to point to a few of the major changes which have followed in their wake.

To establish, harvest and analyse, chemically and statistically, the results of some 700 field tests, to take and analyse 2,200 soil samples and to basket and test 176,000 seedlings is a very full programme for the staff available, but it is gratifying to be able to record :

1. The replacement of D. 625 by P.O.J. 2878, introduced by the Department, fully tested and distributed for general planting;
2. The emergence of several new canes which are consistently out-yielding P.O.J. 2878 in the tests and are now being tried commercially;
3. The large scale adoption of a fertiliser policy which emerged from manurial investigations, with a consequent large increase in the use of nitrogen, the replacement of burnt lime by ground limestone and a reduction in the expenditure on potash and phosphates;
4. A marked advance in our knowledge of the cane soils of the Colony, the mechanics of flood-fallowing and growth curve of cane under local conditions.

Much remains to be done. The search for higher yielding varieties is never-ending and increased breeding is planned. Some soils respond to phosphates and/or lime and/or potash, others do not, yet neither the limits

of the areas in each group nor the relationships between soil analysis and field response have as yet been clearly defined. It will be observed that these questions are now receiving more study; in this respect, attention is drawn to the inclusion in the Bulletin of the results of some chemical research on the phosphate question.

Sometimes the main lines of a long-term programme must cede place in part, or temporarily, to an urgent immediate problem. Of such a nature is the intensified work on substitutes for ammonium sulphate rendered necessary by the war. In this respect too, the possible use of locally available organic wastes (pen manure, filterpress cake, etc.), almost entirely neglected by the local industry in the past, has not been overlooked, and the next Bulletin will report certain experiments on these substances.

Research on methods of cultivation has, so far, received comparatively little attention, but some progress has been achieved and several estates are now trying a new system devised at the Station for local conditions. Should success attend the effort, a contribution of the greatest importance will have been made.

J. SYDNEY DASH,
Director of Agriculture.

FIELD EXPERIMENTS WITH SUGAR CANE, X.

BY

C. HOLMAN B. WILLIAMS, *Sugar Agronomist and Plant Breeder,*

AND

C. CAMERON, *Field Manager.*

INTRODUCTION.

This Bulletin records the results of 40 variety and 21 manurial trials reaped during the year ended June 30, 1941. The method of conducting the trials has been described in previous bulletins of the series and it suffices to say that the layouts (randomised blocks, latin squares, 3 x 3 x 3 complex) permit of the analysis of variance along the lines developed by Fisher and his school. The variety trials are interpreted mainly on yields of sucrose in cane per acre, the manurial trials on yields of cane per acre. For a discussion of the effects of fertilisers on cane quality, readers are referred to *Sugar Bulletin* No. 9, pp. 49–51.

The analyses of the soils of the manurial trial sites are recorded in Appendix I. As a measure of economy, the rainfall records for all trials and the soil data for the variety trial sites have been omitted, and in the tables showing the results of individual variety trials, the data from canes which have done poorly, and have been discarded, are not printed, although in reading the tables it must be borne in mind that such data were used in calculating the means, statistical analyses, etc.

The very adverse rainfall conditions reported in the last Bulletin persisted through much of the period covered by the present publication, and as the irrigation conservancies had already been depleted it was impossible, in most instances, to make good the shortage by irrigation. It will be recalled that the total deficit from the normal, at the Sugar Experiment Station, for the year ended June 30, 1940, was 46.3 in. The following table shows that in the ensuing eleven months the deficit amounted to 18.77 in., making a grand total deficit of 65.07 in. in 23 months.

Comparison of the July–June Rainfall at Sophia Sugar Experiment Station for 1940–41 with the Average for 1921–40.

Month.	Actual Rainfall, 1940–41, in.	Average Rainfall, 1921–40, in.	Excess or Deficit, in.
July	10.11	11.06	–0.95
August	7.35	8.19	–0.84
September	3.14	2.69	0.45
October	3.00	3.77	–0.77
November	4.85	5.38	–0.53
December	14.02	13.56	0.46
January	4.01	9.14	–5.13
February	1.31	4.08	–2.77
March	1.58	4.58	–3.00
April	4.61	5.41	–0.80
May	6.51	11.40	–4.89
June	22.97	13.97	9.00
Total	83.46	93.23	–9.77

The courtesy and willing co-operation of the Managers and Staffs of the Colony's sugar estates are again very gratefully acknowledged.

VARIETY TRIALS.

The variety trials are considered under four sub-sections, *viz.* :—

(a) Plant cane variety trials,
(b) First ratoon variety trials,
(c) Second ratoon variety trials,
(d) Discussion and summary.

SUB-SECTION A.—PLANT CANE VARIETY TRIALS.

PLANT CANE VARIETY TRIALS REAPED AT SOPHIA SUGAR EXPERIMENT STATION.

Data from the seven plant cane variety trials reaped at the Sophia Sugar Experiment Station are presented in Table I and Figure I.

TABLE I.—**Results of Plant Cane Variety Trials Reaped at Sophia Sugar Experiment Station.**

	Variety.	Cane per Acre, Tons.	Pol. % Cane.	Glucose Ratio.	Purity.	Sucrose in Cane per Acre. Tons.	Sucrose in Cane per Acre. % Mean.
		Sophia, Field 1 E. Reaped 6. VI.41 at 20.00 months.					
MEANS OF 5 PLOTS:	D. 47/35	23.15	15.60	4.76	89.5	3.61	117.97
	P.O.J. 2878	18.37	13.65	4.76	84.1	2.51	82.03
	Mean:					3.06	100.00
	Significant Difference, 20: 1:					—	—
		Sophia, Field 8 E. Reaped 13. VI.41 at 11.75 months.					
MEANS OF 5 PLOTS:	Co. 419	28.74	15.97	3.37	90.0	4.59	131.90
	D. 199/36	28.46	14.45	4.09	86.8	4.11	118.10
	D. 419/33	24.70	14.49	6.14	86.2	3.58	102.87
	D. 14/34	22.72	14.99	3.33	89.9	3.41	97.99
	P.O.J. 2878	21.60	14.63	4.89	90.2	3.16	90.80
	*Mean:					3.48	100.00
	Significant Difference, 20: 1:					0.82	23.56
		Sophia, Field 10 E. Reaped 11. X.40 at 15.00 months.					
MEANS OF 5 PLOTS:	D. 249/35	22.66	12.26	10.59	82.3	2.78	151.91
	P.O.J. 2878	20.19	12.89	9.91	83.6	2.60	142.08
	Mean:					1.83	100.00
	Significant Difference, 20: 1:					0.55	30.05
		Sophia, Field 15 E. Reaped 16. VI.41 at 12.00 months.					
MEANS OF 5 PLOTS:	Co. 421	44.29	15.84	4.88	88.8	7.02	158.46
	B. 3013	32.65	15.94	6.24	93.2	5.20	117.38
	P.O.J. 2878	32.18	15.57	4.87	88.1	5.01	113.09
	D. 335/36	32.68	13.88	9.04	85.9	4.54	102.48
	D. 552/33	26.91	16.11	4.77	91.0	4.34	97.97
	D. 14/34	28.53	15.12	4.52	91.1	4.31	97.29
	D. 30/33	25.93	15.39	7.11	92.0	3.99	90.07
	D. 8/33	25.64	14.77	6.14	88.5	3.78	85.33
	D. 493/36	24.36	15.26	4.45	86.6	3.72	83.97
	D. 360/36	23.61	14.83	4.74	91.7	3.50	79.01
	D. 419/33	23.85	13.95	4.94	85.2	3.33	75.17
	Mean:					4.43	100.00
	Significant Difference, 20: 1:					0.84	18.96

*See Introduction, p. 1.

TABLE I. (Contd.)—**Results of Plant Cane Variety Trials Reaped at Sophia Sugar Experiment Station.**

	Variety.	Cane per Acre, Tons.	Pol. % Cane.	Glucose Ratio.	Purity.	Sucrose in Cane per Acre.	
						Tons.	% Mean.
		Sophia,	*Field 1 W.*	*Reaped 10.*	*VII.40 at*	*13.25 months.*	
MEANS OF 5 PLOTS:	P.O.J. 2878	24.21	12.44	6.49	85.7	3.01	171.02
	D. 51/35	16.26	12.48	6.60	86.2	2.03	115.34
	*Mean:					1.76	100.00
	Significant Difference, 20: 1:					0.55	31.25
		Sophia,	*Field 5 W.*	*Reaped 4.*	*X.40 at 15.*	*25 months.*	
MEANS OF 5 PLOTS:	D. 14/34	28.93	13.62	6.16	85.0	3.94	179.09
	D. 199/36	26.54	12.83	11.39	81.0	3.41	155.00
	P.O.J. 2878	21.39	13.53	7.27	82.4	2.89	131.36
	*Mean:					2.20	100.00
	Significant Difference, 20: 1:					0.63	28.64
		Sophia,	*Field 12 W.*	*Reaped 2.*	*X.40 at 16.*	*75 months.*	
MEANS OF 5 PLOTS:	D. 200/36	31.97	15.07	5.50	87.1	4.82	204.24
	D. 174/35	24.99	14.20	4.24	86.8	3.55	150.42
	P.O.J. 2878	20.62	14.64	4.69	87.0	3.02	127.97
	*Mean:					2.36	100.00
	Significant Difference, 20: 1:					0.69	29.24

*See Introduction, p. 1.

In Field 1 E., which suffered severely from the drought, yields were poor and fluctuated greatly from plot to plot. D. 47 35 (D. 11 28 x Diamond 10) outyielded P.O.J. 2878 by a wide margin but was not as satisfactory in Fields 10 E., Sophia and 35 Y.R., Wales. It will therefore have to be tested further.

In Field 8 E., four varieties surpassed the standard, Co. 419 (P.O.J. 2878 x Co. 290) and D. 199/36 (P.O.J. 2878 x Co. 213) being significantly better. All of these canes have done well in other tests and merit further consideration. It is significant that they are all hybrids between P.O.J. 2878 or Diamond 10 and Indian canes.

In Field 10 E., only D. 249/35 (D. 171/29 x Diamond 10) did better than P.O.J. 2878. It has already been put into several other tests.

In Field 15 E., both tonnages and cane quality were satisfactory, Co. 421 (P.O.J. 2878 x B. 3412) being outstanding, as it has always been in the propagation nurseries. B. 3013, which came a poor second, but has a good juice, was below P.O.J. 2878 in Field 8 E., Sophia. Of the varieties below the standard, D. 552 33, D. 14/34, D. 30/33, D. 8/33 and D. 419/33 have all given good results elsewhere and their performance here was unusual and disappointing. D. 360/36 failed both here and in Field 8 E., Sophia, and will be discarded.

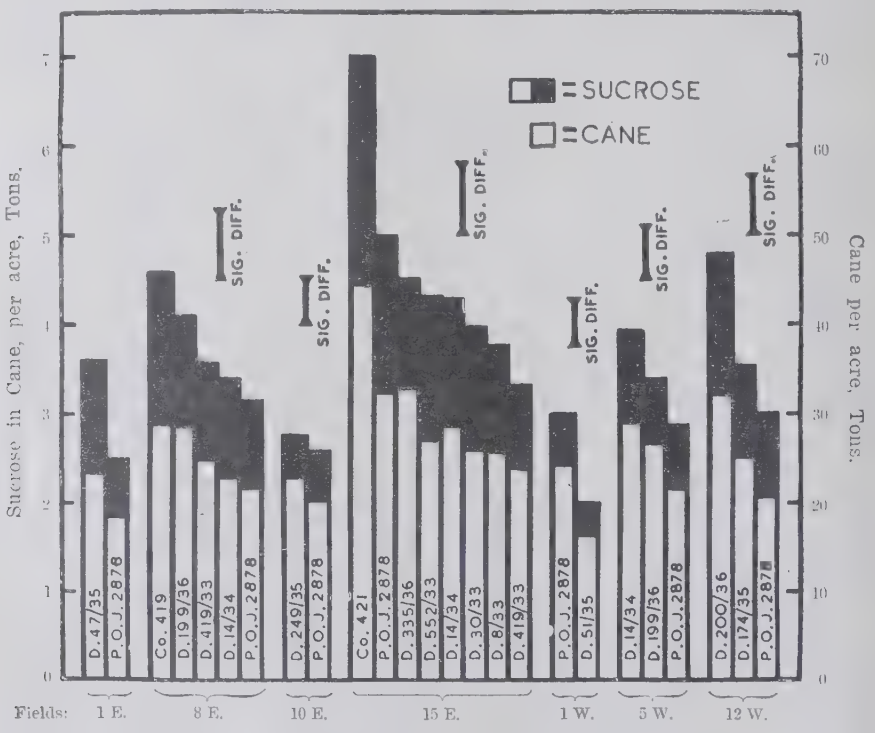
D. 493/36 (P.O.J. 2878 x Diamond 10) has shown much promise in the nurseries but was disappointing in this, its first replicated test. It is already in other tests and will be weighed. D. 335/36 will be weighed again in the ratoons.

In Field 1 W., P.O.J. 2878 was significantly better than all competitors.

In Field 5 W., D. 14/34 (Co. 281 x Diamond 10) and D. 199/36 (P.O.J. 2878 x Co. 213), which have done well elsewhere, led the standard by wide margins. This field suffered severely from the drought and its harvest had to be unduly delayed.

In Field 12 W., D. 200/36 (P.O.J. 2878 x Co. 213) was significantly better than all the other varieties tested and D. 174/35 (D. 49/30 x D. 66/30) also was well ahead of P.O.J. 2878. Both these seedlings are being tested in further trials.

FIG. I.—**Yields from Plant Canes at Sophia.**



PLANT CANE VARIETY TRIALS REAPED IN BERBICE.

The results of four plant cane variety trials reaped in Berbice are presented in Table II and Figure II.

TABLE II.—**Results of Plant Cane Variety Trials Reaped in Berbice.**

	Variety.	Cane per Acre, Tons.	Pol. % Cane.	Glucose Ratio.	Purity.	Sucrose in Cane per Acre. Tons.	Sucrose in Cane per Acre. % Mean.
	Pln. Rose Hall, Field 23 R.H. Reaped 14.VIII. 40 at 13.50 months.						
MEANS OF 5 PLOTS:	P.O.J. 2878	34.26	12.33	8.70	85.4	4.22	115.93
	D. 186/35	26.06	14.63	6.25	87.6	3.81	104.67
	*Mean:					3.64	100.00
	Significant Difference, 20 : 1:					0.49	13.46
	Pln. Blairmont, Field 13 R. Reaped 19.IX. 40 at 13.75 months.						
MEANS OF 5 PLOTS:	Co. 419	59.08	13.72	8.16	87.0	8.11	147.19
	P.O.J. 2878	40.87	13.97	9.08	85.1	5.71	103.63
	D. 51/35	38.43	13.39	10.08	86.9	5.14	93.28
	D. 419/33	33.87	12.78	12.18	83.5	4.33	78.58
	*Mean:					5.51	100.00
	Significant Difference, 20 : 1:					0.80	14.52
	Pln. Blairmont, Field 9 B.L. Reaped 4.IV.41 at 13.50 months.						
MEANS OF 5 PLOTS:	Co. 419	45.90	15.09	7.16	86.6	6.93	101.61
	P.O.J. 2878	44.30	15.15	6.71	86.4	6.71	98.39
	Mean:					6.82	100.00
	Significant Difference, 20 : 1:					—	—
	Pln. Bath, Field 10 L. Reaped 2.XII. 40 at 17.25 months.						
MEANS OF 5 PLOTS:	D. 166/34	24.35	13.85	4.50	86.7	3.37	127.17
	P.O.J. 2878	12.98	14.89	4.64	86.9	1.93	72.83
	Mean:					2.65	100.00
	Significant Difference, 20 : 1:					0.86	32.45

*See Introduction, p. 1.

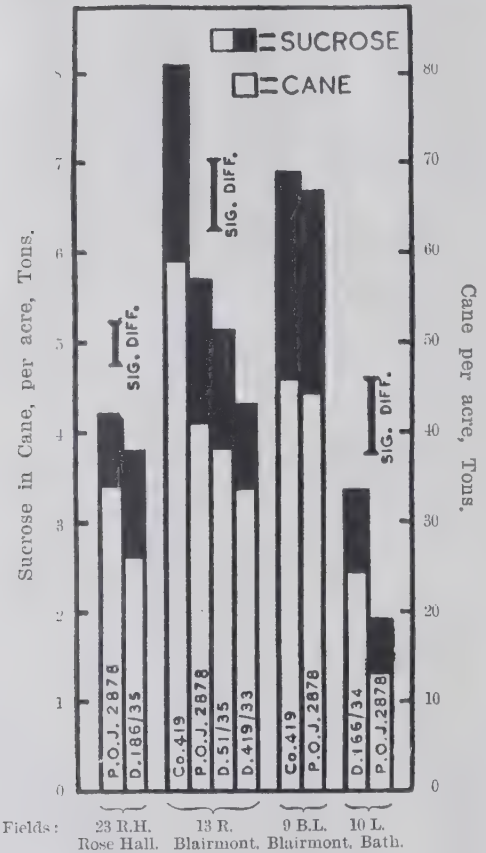
In Field 23 R.H., Rose Hall, P.O.J. 2878 led all competitors and, as a result of this and other tests, they have been discarded.

In Field 13 R., Blairmont, Co. 419 (P.O.J. 2878 x Co. 290) was outstanding and D. 419/33 (Co. 281 x Diamond 10), which has several good results to its credit, was very disappointing. D. 51/35 failed here and elsewhere and has been discarded.

In Field 9 B.L., Blairmont, Co. 419 yielded just slightly better than the standard, the difference being statistically insignificant.

In Field 10 L., Bath, the drought had a very adverse effect on the yield, but D. 166/34 (P.O.J. 2878 x Sorghum) was significantly better than P.O.J. 2878.

FIG. II.—Yields from Plant Canes at Plns. Rose Hall, Blairmont and Bath.



PLANT CANE VARIETY TRIALS REAPED IN EAST DEMERARA.

Data from the six plant cane variety trials harvested in East Demerara are presented in Table III and Figure III.

TABLE III.—**Results of Plant Cane Variety Trials Reaped in East Demerara.**

	Variety.	Cane per Acre, Tons.	Pol. % Cane.	Glucose Ratio.	Purity.	Sucrose in Cane per Acre, Tons.	Sucrose in Cane per Acre, % Mean.
	Pln. Cane Grove, Field 22 N.C.G. Reaped 30.X.40 at 17.25 months.						
MEANS OF 5 PLOTS:	P.O.J. 2878	32.82	15.34	8.28	87.4	5.03	137.43
	D. 49/35	27.73	13.48	12.04	86.4	3.74	102.19
	*Mean:					3.66	100.00
	Significant Difference, 20: 1:					0.52	14.21
	Pln. Lusignan, Field 16 M.X.E. Reaped 21.X.40 at 15.75 months.						
MEANS OF 5 PLOTS:	P.O.J. 2878	27.14	14.17	6.39	82.5	3.85	137.50
	D. 299/35	24.43	12.08	7.03	84.4	2.95	105.36
	*Mean:					2.80	100.00
	Significant Difference, 20: 1:					0.37	13.21
	Pln. La Bonne Intention, Field 27 V.S. Reaped 20.IX.40 at 14.75 months.						
MEANS OF 5 PLOTS:	Co. 419	20.88	11.13	17.06	77.6	2.33	165.25
	D. 299/35	11.84	11.33	17.86	79.2	1.34	95.04
	P.O.J. 2878	12.87	10.09	20.33	74.4	1.30	92.20
	*Mean:					1.41	100.00
	Significant Difference, 20: 1:					0.12	8.51
	Pln. Ogle, Field 68 O. Reaped 28.XI.40 at 12.75 months.						
MEANS OF 5 PLOTS:	D. 14/34	28.83	15.09	4.03	88.1	4.35	134.67
	D. 89/35	28.12	13.20	3.69	84.2	3.71	114.86
	D. 82/35	24.79	14.46	4.84	87.9	3.58	110.84
	P.O.J. 2878	25.09	12.74	5.29	83.8	3.20	99.07
	*Mean:					3.23	100.00
	Significant Difference, 20: 1:					0.59	18.27
	Pln. Ogle, Field 40 I. Reaped 2.X.40 at 14.50 months.						
MEANS OF 5 PLOTS:	D. 166/34	42.30	11.62	6.65	82.5	4.92	174.47
	P.O.J. 2878	38.61	11.38	9.80	81.3	4.39	155.67
	*Mean:					2.82	100.00
	Significant Difference, 20: 1:					0.52	18.44
	Pln. Diamond, Field 55 G.G. Reaped 29.VIII.40 at 16.00 months.						
MEANS OF 5 PLOTS:	P.O.J. 2878	30.03	13.70	5.95	89.1	4.12	146.62
	D. 24/33	17.91	12.70	6.49	88.6	2.27	80.78
	*Mean:					2.81	100.00
	Significant Difference, 20: 1:					0.62	22.06

*See Introduction, p. 1.

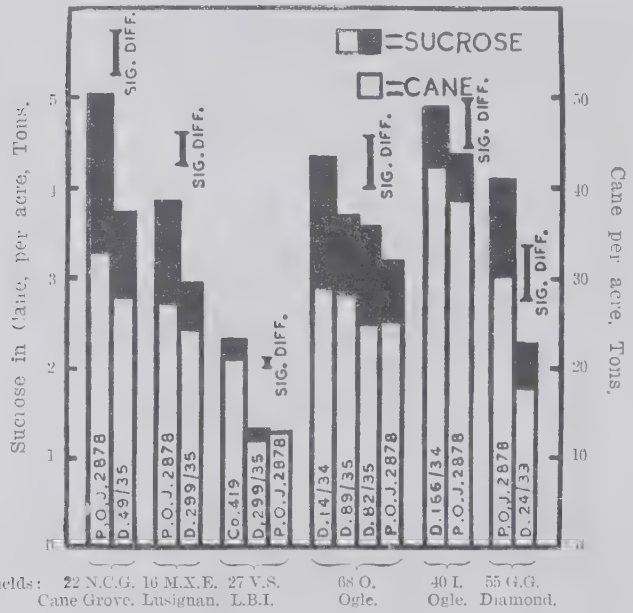
In Fields 22 N.C.G., Cane Grove; 16 M.X.E., Lusignan; and 55 G.G., Diamond; the standard proved better than the other varieties tested and they have been discarded.

In Field 27 V.S., La Bonne Intention, Co. 419 (P.O.J. 2878 x Co. 290) definitely outyielded P.O.J. 2878 by a very wide margin, having shown greater resistance to the drought. D. 299/35 has failed in other tests and has been discarded. The poor juices are attributable to growth promoted by the mid-year showers after a prolonged stunting by the drought.

In Field 68 O., Ogle, D. 14/34 (Co. 281 x Diamond 10) was significantly better than all competitors. D. 89/35 (D. 154/28 x Diamond 10) and D. 82/35 (D. 13/30 x Diamond 10) also led the standard by fair margins. D. 14/34, which also showed the best cane quality in this test, has done well in other trials.

In Field 40 I., Ogle, yields were good despite the drought, and D. 166/34 (P.O.J. 2878 x Sorghum) was significantly better than P.O.J. 2878. The mid-year rains promoted growth just before harvest and lowered the quality of the cane but the differences in this respect were in favour of D. 166/34.

FIG. III.—**Yields from Plant Canes at Plns. Cane Grove, Lusignan, La Bonne Intention, Ogle and Diamond.**



PLANT CANE VARIETY TRIALS REAPED IN WEST DEMERARA.

The results of six plant cane variety trials harvested in West Demerara are shown in Table IV and Figure IV.

TABLE IV.—Results of Plant Cane Variety Trials Reaped in West Demerara.

	Variety.	Cane per Acre, Tons.	Pol. % Cane.	Glucose Ratio.	Purity.	Sucrose in Cane per Acre, Tons.	Sucrose in Cane per Acre, % Mean.
	Pln. Wales, Field 35 Y. R. Reaped 22.IV.41 at 12.25 months.						
MEANS OF 5 PLOTS:	P.O.J. 2878	10.54	14.19	8.59	88.1	1.50	111.11
	D. 47/35	9.21	13.12	10.97	85.6	1.21	89.63
	Mean:					1.35	100.00
	Significant Difference, 20 : 1:					—	—
	Pln. Leonora, Field 29 L. ii. Reaped 29.VIII.40 at 15.25 months.						
MEANS OF 5 PLOTS:	P.O.J. 2878	26.71	13.39	8.02	85.8	3.58	149.17
	D. 32/35	23.89	11.17	7.56	86.9	2.67	111.25
	*Mean:					2.40	100.00
	Significant Difference, 20 : 1:					0.34	14.17
	Pln. Leonora, Field 65 E. Reaped 30.X.40 at 15.00 months.						
MEANS OF 4 PLOTS:	P.O.J. 2878	26.49	13.41	12.61	82.4	3.55	127.70
	D. 331/35	22.41	13.87	9.48	88.0	3.11	111.87
	*Mean:					2.78	100.00
	Significant Difference, 20 : 1:					0.45	16.19
	*Pln. Uitvlugt, Field 13 W. Reaped 28.XI.40 at 12.25 months.						
MEANS OF 5 PLOTS:	D. 14/33	56.15	13.37	8.17	85.4	7.51	138.82
	D. 139/35	45.24	12.41	15.34	79.8	5.61	103.70
	P.O.J. 2878	44.33	12.13	12.47	82.0	5.38	99.45
	D. 116/35	35.98	14.02	7.67	87.6	5.04	93.16
	*Mean:					5.41	100.00
	Significant Difference, 20 : 1:					1.02	18.85
	*Pln. Uitvlugt, Field 84 W. M.Z. Reaped 16.X.40 at 14.75 months.						
MEANS OF 4 PLOTS:	P.O.J. 2878	24.95	16.32	5.79	91.2	4.07	109.41
	D. 331/35	27.24	14.86	6.90	88.3	4.05	108.87
	*Mean:					3.72	100.00
	Significant Difference, 20 : 1:					0.52	13.98
	*Pln. De Kinderen, Field 57 D.K. Reaped 17.X.40 at 14.75 months.						
MEANS OF 4 PLOTS:	P.O.J. 2878	27.73	15.06	7.58	86.4	4.18	106.09
	D. 331/35	27.12	15.36	6.29	89.7	4.16	105.58
	*Mean:					3.94	100.00
	Significant Difference, 20 : 1:					—	—

*See Introduction, p. 1.

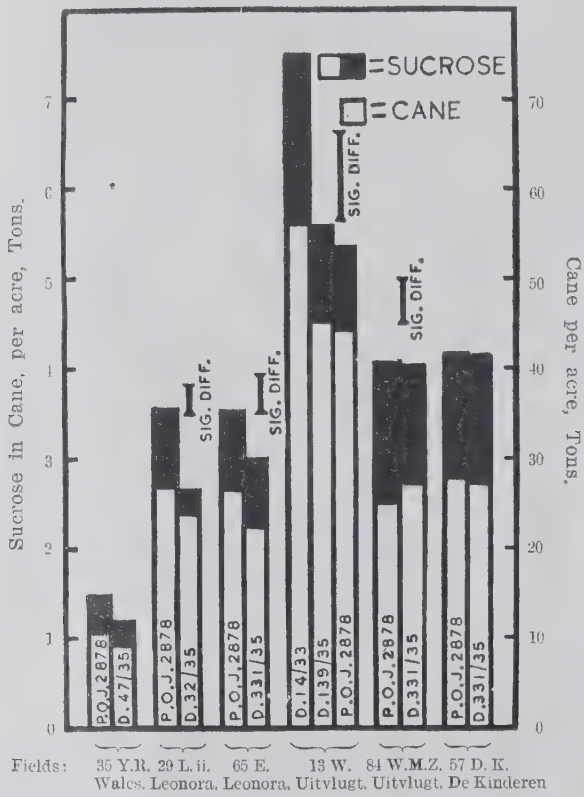
In Field 35 Y.R., Wales, yields were exceedingly poor but P.O.J. 2878 topped the list. D. 47 35, however, has led the standard by a wide margin at Sophia and the plots at Wales will be weighed again as first ratoons.

In Field 29 L. ii, Leonora, P.O.J. 2878 led all competitors and they have been discarded.

In Fields 65 E., Leonora; 84 W.M.Z., Uitvlugt; and 57 D.K., De Kinderen; some 1935 seedlings selected on pegassy clay were compared, on this soil type, with the standard. D. 331/35 (D. 13/30 x Diamond 10) proved to be the best selection, but its yield is not quite up to that of the standard.

In Field 13 W., Uitvlugt, D. 14/33 (Co. 281 x Diamond 10) gave an outstanding yield and was significantly better than all competitors. Both in tonnage and cane quality it was very satisfactory and observations on the plots indicate that it will lead the first ratoon returns. D. 139/35 and D. 116/35 will be given some further consideration.

FIG. IV.—**Yields from Plant Canes at Plns. Wales, Leonora, Uitvlugt and De Kinderen.**



SUB-SECTION B.—FIRST RATOON VARIETY TRIALS.

First Ratoon Variety Trials Reaped at Sophia Sugar Experiment Station.

Five first ratoon variety trials were reaped at the Sophia Sugar Experiment Station and their results are presented in Table V and Figure V.

Table V.—Results of First Ratoon Variety Trials Reaped at Sophia Sugar Experiment Station.

	Variety.	Cane per Acre. Tons.	Pol. % Cane.	Glucose Ratio.	Purity.	Sucrose in Cane per Acre. Tons.	Sucrose in Cane per Acre. % Mean.	Combined Results for 2 Crops, Plants and 1st Ratoons. Variety.	Sucrose in Cane per Acre, Tons.
		Sophia, Field 2 E. Reaped 4. VI.41 at 10.75 months.							
Means of 5 Plots:	D. 11/34	30.30	16.15	3.49	89.1	4.89	138.53		
	D. 199/36	33.61	14.07	7.98	82.6	4.73	133.99		
	Co. 419	31.65	14.56	4.07	85.4	4.61	130.59		
	D. 419/33	28.25	14.52	4.09	86.9	4.10	116.15		
	P.O.J. 2878	22.69	15.32	4.05	86.9	3.48	98.58		
	*Mean:					3.53	100.00		
	Significant Difference, 20 : 1:					0.97	27.18		
		Sophia, Field 3 W. Reaped 2. XII.40 at 16.00 months.							
Means of 5 Plots:	Co. 213	30.63	11.45	7.23	82.3	3.51	121.45	Co. 213	9.01
	D. 49/30	21.48	14.75	5.12	88.9	3.17	109.69	D. 75/30	7.83
	D. 51/33	21.04	14.23	5.88	85.5	2.99	103.46	D. 49/30	7.43
	D. 456/33	17.53	15.56	5.63	86.3	2.73	94.46	D. 51/33	7.27
	P.O.J. 2878	18.06	13.62	5.68	85.8	2.46	85.12	D. 456/33	7.12
	D. 75/30	21.95	11.20	9.30	81.8	2.46	85.12	P.O.J. 2878	6.93
	Mean:					2.89	100.00		
	Significant Difference, 20 : 1:					0.44	15.22		
		Sophia, Field 6 W. Reaped 19. VI.41 at 11.75 months.							
Means of 5 Plots:	D. 166/34	22.80	15.66	4.91	92.2	3.58	125.61	D. 166/34	7.33
	P.O.J. 2878	19.35	15.35	4.01	89.1	2.97	104.21	D. 49/30	6.75
	D. 49/30	16.32	15.46	4.20	91.8	2.52	88.42	P.O.J. 2878	6.72
	Diamond 10	15.75	14.77	4.34	89.6	2.33	81.75	Diamond 10	5.59
	Mean:					2.85	100.00		
	Significant Difference, 20 : 1:					—	—		
		Sophia, Field 8 W. Reaped 7. X.40 at 14.25 months.							
Means of 5 Plots:	D. 166/34	30.12	13.05	7.73	86.5	3.93	309.45	D. 166/34	7.60
	D. 552/33	13.34	14.39	6.97	86.4	1.92	151.18	D. 552/33	5.47
	D. 51/33	9.47	13.38	7.09	85.8	1.27	100.00	D. 51/33	3.93
	P.O.J. 2878	8.72	13.22	5.59	83.8	1.15	90.55	P.O.J. 2878	3.20
	*Mean:					1.27	100.00		
	Significant Difference, 20 : 1:					0.55	43.31		
		Sophia, Field 9 W. Reaped 4. XII.40 at 12.75 months.							
Means of 5 Plots:	Co. 213	24.90	12.57	9.64	80.4	3.13	126.72	Co. 213	9.90
	P.O.J. 2878	16.72	13.37	6.08	84.8	2.24	90.69	P.O.J. 2878	7.72
	D. 63/33	14.62	13.99	4.00	87.8	2.05	83.00	D. 63/33	7.52
	Mean:					2.47	100.00		
	Significant Difference, 20 : 1					0.59	23.89		

*See Introduction, p. 1.

In Field 2 E., the plant cane germination was so affected by the drought that the plots were drawn down and replanted. In consequence, first ratoon but no plant cane results are available. Considering the conditions, the first ratoon yields were satisfactory. D. 14/34 (Co. 281 x Diamond 10), D. 199/36 (P.O.J. 2878 x Co. 213) and Co. 419 (P.O.J. 2878 x Co. 290) were all significantly better than the standard, which was also surpassed by D. 419 33 (Co. 281 x Diamond 10). D. 14/34 again showed very satisfactory cane quality.

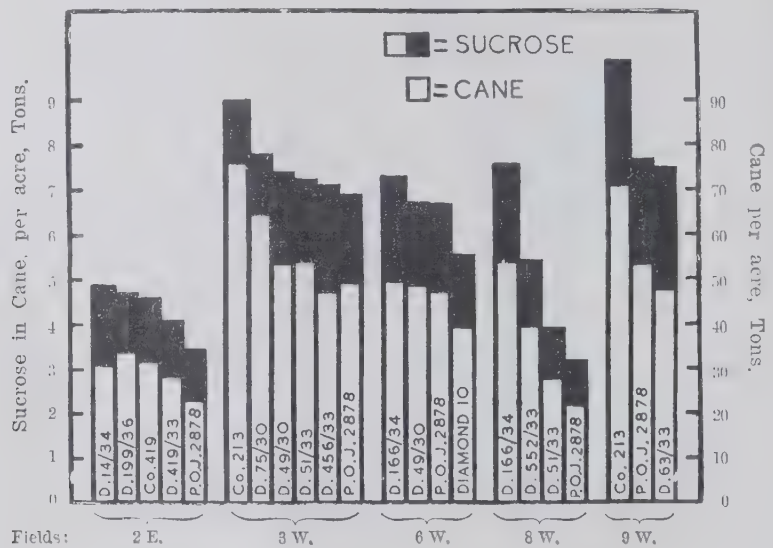
In Field 3 W., Co. 213 was outstanding both as a first ratoon and in total yield for two crops. The other canes have not generally proved themselves the equal of P.O.J. 2878.

In Field 6 W., D. 166/34 gave the highest yield and the best quality cane as a first ratoon and leads the standard by a wide margin in total output for two crops.

In Field 8 W., the effects of the drought were marked on all canes except D. 166/34 which left all competitors far behind. D. 552/33 (D. 219/30 x Diamond 10), whose record is good, resisted better than P.O.J. 2878 and outyielded it by a significant margin.

In Field 9 W., Co. 213 was significantly better than all competitors.

FIG. V.—**Yields from Plant Canes and First Ratoons at Sophia.**



First Ratoon Variety Trials Reaped in Berbice and East Demerara.

One first ratoon variety trial was harvested in Berbice and three in East Demerara. Their results are presented together in Table VI and Figure VI.

Table VI.—Results of First Ratoon Variety Trials Reaped in Berbice and East Demerara.

	Variety.	Cane per Acre, Tons.	Pol. %. Cane.	Glucose Ratio.	Purity.	Sucrose in Cane per Acre, Tons.	Sucrose in Cane per Acre, % Mean.	Combined Results for 2 Crops, Plants, and 1st Ratoons. Variety.	Sucrose in Cane per Acre, Tons.
	Pln. Port	*Mourant, Field 13 A.*			*Reaped*	*5.VI.*	*41 at 13.*	*75 months.*	
Means of 4 Plots:	Co. 419	54.97	12.87	9.05	82.2	7.07	103.67	Co. 419	14.07
	P.O.J. 2878	46.78	14.06	6.04	86.0	6.57	96.33	P.O.J. 2878	12.73
	Mean:					6.82	100.00		
	Significant Difference, 20: 1:					—	—		
	Pln. Lusignan,	*Field 23*	*M.X.E.*		*Reaped*	*31.X.40*	*at 12.*	*25 months.*	
Means of 2 Plots:	D. 456/33	26.02	15.18	8.14	87.3	3.95	104.77	D. 456/33	10.80
	Diamond 10	24.08	16.26	7.17	86.8	3.91	103.71	Diamond 10	9.60
	P.O.J. 2878	24.21	15.31	8.58	86.1	3.70	98.14	D. 450/33	9.04
	D. 450/33	24.54	14.41	10.15	83.6	3.54	93.90	P.O.J. 2878	8.93
	Mean:					3.77	100.00		
	Significant Difference, 20: 1:					—	—		
	Pln. La	*Bonne*	*Intention, Field*	*38 L.R.*		*Reaped*	*20.IX.*	*40 at 14.00*	*months.*
Means of 5 Plots:	D. 51/33	22.92	11.92	14.91	80.8	2.73	118.70	D. 51/33	10.16
	P.O.J. 2878	16.38	11.40	14.32	84.5	1.87	81.30	P.O.J. 2878	10.13
	Mean:					2.30	100.00		
	Significant Difference, 20: 1:					0.51	22.17		
	Pln. Diamond,	*Field*	*16 G.*		*Reaped*	*11.IX.*	*40 at 12.*	*50 months.*	
Means of 5 Plots:	D. 419/33	33.85	12.86	9.21	85.7	4.35	158.18	D. 419/33	7.47
	Co. 290	18.99	12.18	7.26	85.8	2.31	84.00	Co. 290	6.04
	Diamond 10	17.71	12.03	16.05	81.3	2.13	77.45	Diamond 10	5.44
	Mean:					2.75	100.00		
	Significant Difference, 20: 1:					0.43	15.64		

*See Introduction, p. 1.

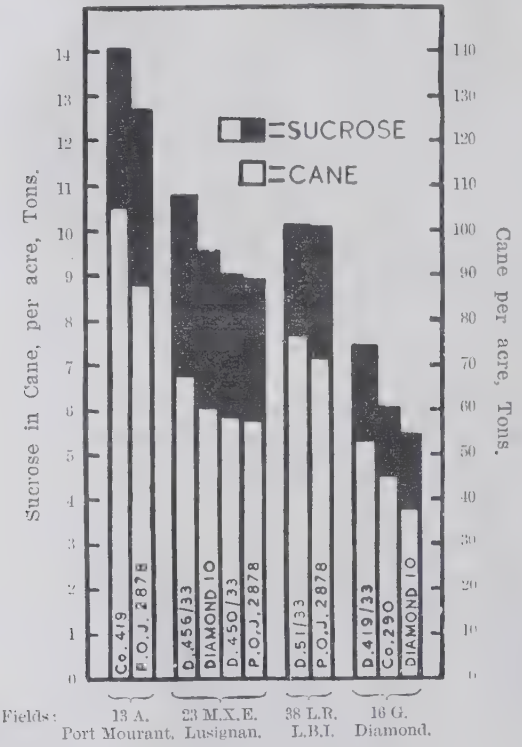
In Field 13 A., Port Mourant, very high yields were recorded, with Co. 419 leading the standard by a wide margin both as a first ratoon and in total yield for two crops.

In Field 23 M.X.E., Lusignan, D. 456/33 was the best yielder of cane and its juice was satisfactory in quality.

In Field 38 L.R., La Bonne Intention, D. 51/33 stood up to the adverse conditions better than did P.O.J. 2878 and gave a significantly better yield.

In Field 16 G., Diamond, D. 419/33 (Co. 281 x Diamond 10) proved significantly better than all competitors and is two tons of sucrose ahead of Diamond 10 in total yield for two crops.

FIG. VI.—**Yields from Plant Canes and First Ratoons at Plns. Port Mourant, La Bonne Intention and Diamond.**



SUB-SECTION C.—SECOND RATOON VARIETY TRIALS.

Three second ratoon variety tests were harvested at the Sophia Sugar Experiment Station, one in Berbice, and two each in East and West Demerara. Their results are presented in Table VII and Figure VII.

TABLE VII.—Results of Second Ratoon Variety Trials Reaped at Sophia Sugar Experiment Station, Berbice, East and West Demerara.

	Variety.	Cane per Acre, Tons.	Pol. %. Cane.	Glucose Ratio.	Purity.	Sucrose in Cane per Acre, Tons.	Sucrose in Cane per Acre, % Mean.	Combined Results for 3 Crops, Plants, 1st and 2nd Ratoons. Variety.	Sucrose in Cane per Acre, Tons.
		Sophia, Field 10		*W. Reaped 5.X*		*II.40 at*	*15.75*	*months.*	
MEANS OF 5 PLOTS:	D. 552/33	14.94	13.60	5.61	86.8	2.03	130.13	D. 552/33	11.84
	P.O.J. 2878	15.73	12.55	8.19	83.2	1.97	126.28	D. 63/33	10.54
	D. 63/33	9.29	13.06	5.34	86.5	1.21	77.56	P.O.J. 2878	10.47
	D. 67/30	8.04	12.98	6.68	85.8	1.04	66.67	D. 67/30	9.89
	Mean:					1.56	100.00		
	Significant Difference, 20: 1:					0.31	19.87		
		Sophia, Field 11		*W. Reaped 17.*		*VI.41*	*at 19.00*	*months.*	
MEANS OF 5 PLOTS:	D. 419/33	18.34	14.01	4.50	84.4	2.57	120.66	D. 419/33	11.30
	P.O.J. 2878	14.48	13.40	6.48	85.0	1.94	91.08	P.O.J. 2878	8.31
	D. 119/34	14.10	13.24	7.23	85.9	1.87	87.79	D. 119/34	7.92
	Mean:					2.13	100.00		
	Significant Difference, 20: 1					—	—		
		Sophia, Field 14		*W. Reaped 8.X.*		*40 at 14.*	*25 months.*		
MEANS OF 5 PLOTS:	D. 75/30	19.85	13.40	9.79	85.8	2.66	107.26	P.O.J. 2878	10.00
	P.O.J. 2878	15.82	14.56	4.87	88.7	2.30	92.74	D. 75/30	9.82
	Mean:					2.48	100.00		
	Significant Difference, 20: 1:					—	—		
		Pln.	*Bath. Field 7 F.*		*Reaped*	*24.III.*	*41 at 10.*	*25 months.*	
MEANS OF 5 PLOTS:	P.O.J. 2878	25.98	15.86	6.34	88.5	4.12	119.42	P.O.J. 2878	18.25
	D. 49/30	22.20	14.41	4.34	89.2	3.20	92.75	Co. 213	17.66
	Co. 213	28.05	10.55	6.89	81.2	3.02	87.54	D. 49/30	15.37
	Mean					3.45	100.00		
	Significant Difference, 20: 1:					0.72	20.87		
		Pln. La	*Bonne Intention*		*. Field 15 F. Reaped 4.X*			*II.40 at 13.00 mths.*	
MEANS OF 5 PLOTS:	D. 166/34	37.10	14.80	4.09	85.5	5.49	118.57	D. 166/34	18.55
	Diamond 10	29.71	14.56	6.33	85.6	4.32	93.30	Diamond 10	15.49
	D. 51/33	30.79	13.27	13.29	81.9	4.09	88.34	D. 51/33	15.30
	Mean:					4.63	100.00		
	Significant Difference, 20: 1:					0.26	5.62		
		Pln. Di	*amond,*	*Field 11*	*9 G.D.*	*Reaped*	*30.VIII*	*.40 at 13.50*	*months.*
MEANS OF 5 PLOTS:	P.O.J. 2878	8.32	9.97	12.02	80.9	0.83	140.68	P.O.J. 2878	11.40
	Co. 213	7.78	7.73	11.21	75.0	0.60	101.69	Co. 213	9.86
	Diamond 10	3.24	10.07	7.69	82.9	0.33	55.93	Diamond 10	7.66
	Mean:					0.59	100.00		
	Significant Difference, 20: 1:					0.13	22.03		
		Pln. Ve	*rsailles,*	*Field 34*	*V.S. Reaped 9.*		*X.40 at*	*11.75 mon*	*ths.*
MEANS OF 4 PLOTS:	Diamond 10	27.20	13.52	11.51	83.9	3.68	104.55	Diamond 10	16.01
	D. 456/33	27.35	12.32	14.14	81.7	3.37	95.74	D. 456/33	14.76
	Mean:					3.52	100.00		
	Significant Difference, 20: 1:					—	—		
		Pln. Leo	*nora, Field 35 C.*		*I. Reaped 29.X.*		*40 at 11.*	*75 months.*	
MEANS OF 5 PLOTS:	D. 166/34	27.80	13.52	6.81	84.9	3.76	104.44	D. 166/34	15.40
	Diamond 10	25.32	13.58	8.94	86.6	3.44	95.56	Diamond 10	13.95
	Mean:					3.60	100.00		
	Significant Difference, 20: 1:					—	—		

In Field 10 W., Sophia, yields were poor but D. 552/33 (D. 219/30 x Diamond 10) averaged a total increment of 1.37 Tons sucrose per acre over P.O.J. 2878 in the 3-crop cycle.

In Field 11 W., Sophia, yields were also poor but D. 419/33 (Co. 281 x Diamond 10) led the standard by a wide margin as a second ratoon and in total yield for three crops.

In Field 14 W., Sophia, D. 75/30 gave 4 tons cane per acre more than the standard as a second ratoon but was beaten by P.O.J. 2878 in total yield of sucrose per acre for three crops.

In Field 7 F., Bath, Co. 213 gave the best cane yield but was handicapped by the early harvest as regards cane quality and so was beaten by the standard in the total yield for the cycle.

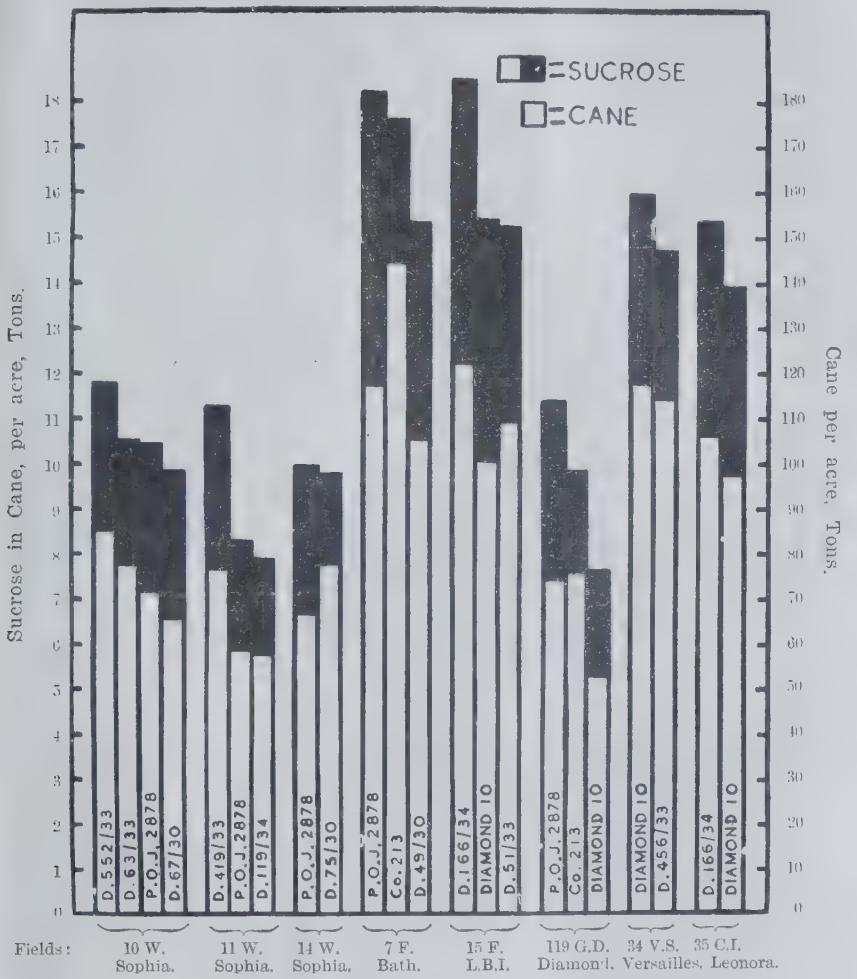
In Field 15 F., La Bonne Intention, yields were satisfactory and D. 166/34 (P.O.J. 2878 x Sorghum) was significantly better than all competitors, being three tons of sucrose per acre above Diamond 10 in the total yield for the cycle.

In Field 119 G.D., Diamond, the second ratoon yields were exceedingly poor but both P.O.J. 2878 and Co. 213 gave twice as much cane as Diamond 10 and were significantly better in sucrose yield, indicating their marked superiority under unfavourable conditions.

In Field 34 V.S., Versailles, Diamond 10 outyielded D. 456/33 as a second ratoon and in the total for the cycle.

In Field 35 C.I., Leonora, D. 166/34 (P.O.J. 2878 x Sorghum) maintained its lead over Diamond 10, totalling 1.45 tons sucrose per acre more in the three crops.

FIG. VII.—**Yields from Plant Canes, First and Second Ratoons at Sophia, Plns. Bath, La Bonne Intention, Diamond, Versailles and Leonora.**



SUB-SECTION D.—DISCUSSION AND SUMMARY OF RESULTS.

Table VIII summarises, for all experiments, the relative status of the varieties which have been reaped as plant canes, first and second ratoons.

TABLE VIII.—**Mean Sucrose Yields from Three Crops.**

Variety.	Mean Sucrose, Tons per acre (Corrected Values).				Total Yield, P.O.J. 2878 =100.0
	Plants.	First Ratoons.	Second Ratoons.	Total.	
D. 419/33	**4.48**	*5.98*	4.29	14.75	123.02
D. 166/34	**5.78**	*4.66*	4.27	14.71	122.69
D. 552/33	*5.42*	4.80	3.49	13.71	114.35
Co. 213	**4.46**	**4.22**	**3.73**	**12.41**	**103.50**
D. 51/33	*4.73*	*3.98*	3.39	12.10	100.92
P.O.J. 2878	**4.71**	**3.89**	**3.39**	**11.99**	**100.00**
D. 75/30	**4.99**	**3.56**	**3.32**	**11.87**	**99.00**
Diamond 10	**4.48**	**3.58**	**3.58**	**11.64**	**97.08**
D. 49/30	**4.24**	**3.78**	**3.57**	**11.59**	**96.66**
D. 24/33	**3.76**	*3.94*	3.86	11.56	96.41
D. 119/34	4.97	3.32	3.27	11.56	96.41
D. 8/33	3.97	4.33	3.20	11.50	95.91
D. 456/33	**4.78**	**3 35**	3.28	11.41	95.16
D. 67/30	**4.85**	*3.47*	*3.02*	*11.34*	*94.58*
D. 30/33	4.34	3.64	3.32	11.30	94.25
D. 63/33	4.80	4.18	2.08	11.06	92.24

NOTE :—**Heavy type indicates means of six or more tests ;**
Italics indicate means of three to five tests ;
Ordinary type indicates one test or mean of two.

D. 419/33 (Co. 281 x Diamond 10) which has been reaped six times as plants, four times as first ratoons and twice as second, continues, as in the last Bulletin, to head the list. Although somewhat thin, it is stouter and easier to handle than Co. 213 and yields a cane of much better quality. It is a good ratooner. Further tests with this cane are in progress but there is enough evidence available to warrant the extension of the estates' nurseries. D. 419/33 contains slightly more fibre than does P.O.J. 2878.

D. 166/34 (P.O.J. 2878 x Sorghum), which now enters the three-crop table for the first time, comes a close second to D. 419/33, with an average of over 22 per cent. increase on P.O.J. 2878 in six plant, four first ratoon and two second ratoon experiments. This is an excellent field cane which covers in early, ratoons heavily and yields stout easy-harvesting and easy-loading canes. It is a soft miller and the juice gives no trouble in the factory. One factory reported steam trouble in one test but several others have handled the cane without this

difficulty and in a later test at the complaining factory no trouble was experienced. There is evidence that this cane should be harvested at 11-12 months as plants. No time should be lost in extending every bit of D. 166/34 available.

D. 552/33 (D. 219/30 x Diamond 10) has only been harvested thrice as a plant, twice as a first ratoon and once as a second and further results are being awaited from trials already started. This variety is entirely of 'noble' parentage and yields cane of high quality.

Co. 213 has been fully discussed in previous Bulletins. On account of its hardiness and strong ratooning power, it is being given commercial consideration on certain estates. It is a cane of high fibre content as compared with P.O.J. 2878.

D. 51/33 (D. 666/18 x Diamond 10) has averaged, in four plant tests, four first ratoon and one second ratoon, about the same yield as P.O.J. 2878. It is unlikely to compete successfully against D. 166/34 and other more promising canes, but the experiments already started will be harvested as second ratoons.

The canes below P.O.J. 2878 will be discarded from the tests.

Table IX summarises the results from experiments with varieties harvested as plant canes and first ratoons only.

TABLE IX.—**Mean Sucrose Yields from Two Crops.**

Variety.	Mean Sucrose, Tons per acre (Corrected Values).			Total Yield, P.O.J. 2878 =100.0
	Plants.	First Ratoons.	Total.	
D. 199/36	5.85	5.29	11.14	129.53
D. 14/34	*5.29*	5.47	10.76	125.12
Co. 419	*5.92*	4.52	10.44	121.40
P.O.J. 2878	**4.71**	**3.89**	**8.60**	**100.00**
D. 70/34	5.28	2.94	8.22	95.58
Diamond 10	**4.48**	**3.58**	**8.06**	**93.72**
Co. 290	*3.97*	3.89	7.86	91.40
D. 450/33	**4.41**	*3.42*	*7.83*	*91.05*
D. 121/34	4.99	2.60	7.59	88.26
D. 116/34	4.62	2.96	7.58	88.14
D. 169/34	6.20	1.18	7.38	85.81
D. 123/34	4.92	2.16	7.08	82.33
D. 165/34	3.44	3.02	6.46	75.12
D. 62/35	—	2.30	—	—
D. 338/36	—	1.88		

NOTE :—**Heavy type indicates means of six or more tests ;**
Italics indicate means of three to five tests ;
Ordinary type indicates one test or mean of two.

D. 199/36 (P.O.J. 2878 x Co. 213) is a heavy yielder of mediocre quality, low-fibre, cane which has only been reaped twice as a plant and once as a first ratoon. It is being tested further.

D. 14/34 (Co. 281 x Diamond 10), which has been tested four times as a plant and once as a first ratoon, yields high quality cane and appears very promising. A few nurseries are being established on the estates pending further experimental results. D. 14/34 has about the same fibre content as has P.O.J. 2878.

Co. 419 (P.O.J. 2878 x Co. 290) is an Indian variety which has grown excellently in the nurseries both at the Station and on the estates. It has averaged 21.4 per cent. above P.O.J. 2878 in the five plant and two first ratoon trials so far harvested. It gives more cane than P.O.J. 2878 with a sucrose content and juice purity about the same as those of the standard, but is slightly lower in fibre.

The varieties below P.O.J. 2878 will be discarded.

The canes listed in Table X have been tested only as plants.

TABLE X.—Mean Sucrose Yields from Plant Canes.

Variety.	Mean Sucrose, Tons per acre (Corrected Values). Plants.	Yield, P.O.J. 2878 =100.0	Variety.	Mean Sucrose, Tons per acre (Corrected Values). Plants.	Yield, P.O.J. 2878 =100.0
D. 200/36	7.56	159.49	*D. 197/35*	*3.47*	*73.21*
Co. 421	6.64	140.08	B. 3127	3.45	72.78
D. 14/33	6.62	139.66	D. 157/34	3.42	72.15
D. 174/35	5.57	117.51	D. 187/35	3.41	71.94
D. 89/35	5.50	116.03	D. 170/35	3.39	71.52
D. 82/35	5.30	111.81	*D. 299/35*	*3.37*	*71.10*
D. 47/35	*5.26*	*110.97*	D. 42/35	3.31	69.83
D. 249/35	5.07	106.96	D. 273/36	3.30	69.62
D. 139/35	4.94	104.22	D. 146/36	3.23	68.14
			B. 3011	3.20	67.51
P.O.J. 2878	**4.74**	**100.00**	D. 351/36	3.19	67.30
			D. 31/35	3.17	66.88
B. 3013	4.72	99.58	D. 40/35	3.16	66.67
D. 331/35	*4.55*	*95.99*	**D. 186/35**	**3.14**	**66.24**
Diamond 10	**4.51**	**95.15**	D. 342/35	3.06	64.56
D. 116/35	4.44	93.67	D. 41/35	3.00	63.29
D. 287/35	4.43	93.46	D. 208/35	2.97	62.66
D. 45/35	4.42	93.25	D. 56/35	2.93	61.81
D. 193/35	4.36	91.98	D. 145/36	2.92	61.60
D. 263/35	4.33	91.35	D. 182/35	2.83	59.70
D. 48/35	4.32	91.14	B. 3124	2.78	58.65
D. 307/35	4.31	90.93	*D. 192/35*	*2.76*	*58.23*
D. 335/36	4.30	90.72	D. 221/35	2.66	56.12
D. 335/35	4.11	86.71	D. 55/35	2.62	55.27
D. 141/36	4.05	85.44	D. 148/36	2.61	55.06
D. 32/35	**4.04**	**85.23**	*D. 33/35*	*2.54*	*53.59*
D. 34/35	4.03	85.02	D. 169/35	2.53	53.38
D. 51/35	*3.99*	*84.18*	D. 37/35	2.46	51.90
D. 198/36	3.85	81.22	*D. 194/35*	*2.36*	*49.79*
D. 167/35	3.72	78.48	D. 132/34	2.33	49.16
D. 181/35	3.71	78.27	D. 177/35	2.26	47.68
D. 341/35	*3.69*	*77.85*	D. 171/35	2.20	46.41
D. 185/35	**3.61**	**76.16**	D. 154/36	2.20	46.41
D. 289/35	3.60	75.95	D. 195/35	2.12	44.73
D. 230/35	3.58	75.53	D. 259/35	2.08	43.88
B. 3216	3.56	75.11	B. 3234	1.93	40.72
D. 44/35	3.54	74.68	D. 313/35	1.54	32.49
D. 204/36	3.53	74.47	D. 243/35	1.33	28.06
D. 493/36	3.52	74.26			
D. 360/36	3.52	74.26			
D. 49/35	3.48	73.42			

NOTE:—**Heavy type indicates means of six or more tests;**
Italics indicate means of three to five tests;
Ordinary type indicates one test or mean of two.

D. 200/36 (P.O.J. 2878 x Co. 213) has yielded, in one plant cane test, eleven tons of cane per acre over P.O.J. 2878. The cane was of slightly better quality than that of the standard. This variety appears to be ratooning well.

Co. 421 (P.O.J. 2878 x B. 3412) is an Indian variety which has only been reaped in one experiment, but whose growth in the nurseries leaves no doubt as to its fine field qualities. In the one plant cane test mentioned it averaged a yield of sucrose per acre more than 40 per cent. above P.O.J. 2878, yielding 12 tons more cane per acre with a slightly higher sucrose content and juice purity. Co. 421 is a cane of high fibre content.. Several estates already have nurseries of this cane and the others will all be supplied with it before the end of the year.

D. 14/33 (Co. 281 x Diamond 10) duplicated the performance of Co. 421 in relation to P.O.J. 2878 for, in the single trial reaped at Uitvlugt, it gave 12 tons more cane and a higher sucrose content and juice purity. It is being extended as rapidly as possible.

The remaining canes all require further testing except those below B. 3015, which will be discarded.

Recommendations :

Estates are advised to

(a) bring D. 166/34 into commercial cultivation as rapidly as possible;

(b) establish and extend nurseries and a few fields of D. 419/33, D. 14/34, Co. 419 and Co. 421;

(c) continue commercial tests with Co. 213 and D. 49/30 on suitable areas.

MANURIAL TRIALS.

The results of twenty-one manurial trials, harvested during the period under review, are recorded under five sub-sections, *viz.* :—

A—Nitrogenous manures

B—Phosphatic manures

C—Potassic manures

D—Liming materials

E—Discussion and summary.

Certain experiments, involving manuring with nitrogen and phosphate or nitrogen and potash, are treated, for convenience, under sub-section A (A 6—A 9, A 13), and in this respect there is some overlapping between the sub-sections.

Some of the trials (A 1, A 2, A 10 to A 12, B 5 and B 6) were of a complex nature, involving graded dressings of nitrogen, phosphate and potash or limestone, phosphate and potash. The response to each element is discussed under the appropriate sub-section.

SUB-SECTION A.—NITROGENOUS MANURES.

(A 1—A 2) Sulphate of Ammonia on Flood-Fallowed Frontland (Fourth Ratoons, P.O.J. 2878).

Fields 81 R.H., Rose Hall; and 26 Rp., Blairmont.

(*Plant cane results reported in Sugar Bull. No. 6, p. 57.*)
(*First ratoon results reported in Sugar Bull. No. 7, p. 70.*)
(*Second ratoon results reported in Sugar Bull. No. 8, p. 52.*)
(*Third ratoon results reported in Sugar Bull. No. 9, p. 30.*)

The results from these tests appear in Table XI, where it will be seen that there were no significantly different effects from the varied treatments. Tonnage was satisfactory at Rose Hall and it is unusual for the 4 cwt. application not to have outyielded the 2 cwt. by a significant margin. At Blairmont the experiment was adversely affected by the drought.

TABLE XI.—Effect of Sulphate of Ammonia on Fourth Ratoons of P.O.J. 2878 on Flood-fallowed Frontland.

Sulphate of Ammonia, Cwt. per Acre.	Mean Yields in Tons Cane per Acre at	
	81 R.H.	26 Rp. *
2	28.25	19.07
4	28.61	17.11
6	30.29	18.35
Sig. Diff. 20 : 1	—	—

* Residual Effect.

(A 3) SULPHATE OF AMMONIA AND CYANAMIDE ON FLOOD-FALLOWED FRONTLAND (PLANT CANES, P.O.J. 2878).

Field 2 B.L., Blairmont.

This experiment was designed by Mr. Birkett, Chemist at Blairmont, who requested the co-operation of the Station in its execution. Table XII shows that there were no significant differences in the results. Weather conditions were unfavourable and the cane was, apparently, unable to use the 2 cwt. application which normally proves economically sound for plants.

TABLE XII.—Effect of Sulphate of Ammonia and Cyanamide on Plant Canes of P.O.J. 2878 on Flood-fallowed Frontland.

Treatments/Acre.	Mean Yields in Tons Cane per Acre.
Nil	37.07
2 Cwt. S. of Ammonia	38.17
4 „ „ „ „	42.28
2 „ Cyanamide	39.80
4 „ „	40.76
Sig. Diff. 20 : 1	—

(A 4—A 5) SULPHATE OF AMMONIA AND NITROCHALK ON FLOOD-FALLOWED FRONTLAND (PLANT CANES, P.O.J. 2878).

Fields 60 I., Ogle; and 41 N.P., Enmore.

At the request of a representative of Messrs. Imperial Chemical Industries, Ltd., four experiments were started to compare ammonium sulphate and Nitrochalk on a bag per bag basis, ignoring their varying nitrogen contents. The plots at Lusignan and La Bonne Intention were harvested by the Estates concerned in error, but Table XIII shows that at the two other sites there were no material differences in the yields of cane from the two manures.

TABLE XIII.—**Effect of Ammonium Sulphate and Nitrochalk on Plant Canes of P.O.J. 2878 on Flood-fallowed Frontland.**

Treatments.	Lb. per Acre, N.	Mean Yields in Tons Cane per Acre at	
		60 I.	41 N.P.
Sulph. of Ammonia	47	36.45	13.35
Nitrochalk	36	35.10	13.61
Sig. Diff. 20 : 1		—	—

(A 6) NITROGENOUS AND PHOSPHATIC MANURES ON FLOOD-FALLOWED FRONTLAND (PLANT CANES, P.O.J. 2878).

Field 18 G.W., Providence, Berbice.

This experiment forms one of a small chain of three designed to compare various sources of nitrogen and to test, at the same time, if there is any response on frontland to phosphate as Rock Phosphate or as Nicifos. Only one trial of the chain has, so far, been harvested. It is doubtful whether the adverse weather conditions permitted the cane to utilise the nitrogen applied, but it will be seen from Table XIV and Figure VIII that there were no significant differences between ammonium sulphate, cyanamide and sodium nitrate as sources of nitrogen and that Nicifos proved significantly better than anything else tried. There was a tendency for rock phosphate to increase the yield when it was used, but the phosphate in Nicifos was apparently more effective. The available phosphate content of this site is low, only 15 parts per million (Truog) being available in the first foot and the same quantity in the second foot of soil.

TABLE XIV.—**Effect of Nitrogenous and Phosphatic Manures on Plant Canes of P.O.J. 2878 on Flood-fallowed Frontland.**

Treatments.	Lb. per Acre		Mean Yields in Tons Cane per Acre
	N	P_2O_5	
S. Ammonia	47	—	19.63
Cyanamide	47	—	18.91
N. Soda	47	—	20.35
S. Amm. plus Rock Phosphate	47	47	20.37
Cyanamide plus Rock Phosphate	47	47	20.20
N. Soda plus Rock Phosphate	47	47	21.68
Nicifos	47	47	24.03
Sig. Diff. 20 : 1	—	—	2.13

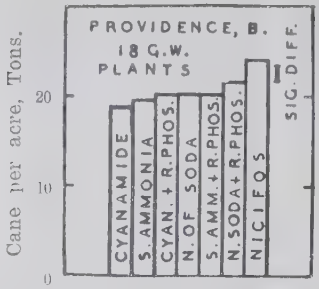


FIG. VIII.—Effect of Nitrogenous and Phosphatic Manures on P.O.J. 2878 on Flood-fallowed Frontland.

(A 7—A 9) NITROGENOUS AND PHOSPHATIC MANURES ON FLOOD-FALLOWED FRONTLAND (FIRST AND SECOND RATOONS, P.O.J. 2878).

Fields 23 Rp., Blairmont; and 1 F.F.A. and 31 S., Rose Hall.

(*Plant cane results reported in Sugar Bulls. No. 8, p. 58 and No. 9, p. 32.*)

(*First ratoon results reported in Sugar Bull. No. 9, p. 34.*)

Table XV shows that at Blairmont the yields were satisfactory and Nicifos, which had definitely outyielded the other manures in the plants, was again first, being significantly better than Nitrochalk alone or in combination with basic slag (see also A 6, above, for the effect of Nicifos on a neighbouring estate), but not significantly better than ammonium sulphate. The results are shown graphically in Figure IX.

At Rose Hall, yields were poor in 1 F.F.A. and only fair in 31 S. There were no significant differences between the yields of the various treatments, but Nicifos headed the list in both fields. These three sites all show a chemical deficiency of available phosphate and it is surprising that more definite responses to phosphatic manuring are not obtained. It may be that a question of placement is involved and this is being investigated.

TABLE XV.—Effect of Various Nitrogenous and Phosphatic Manures on First and Second Ratoons of P.O.J. 2878 on Flood-fallowed Frontland.

Treatments	Lb. per Acre.		Mean Yields in Tons Cane per Acre at		
	N.	P_2O_5	23 Rp., 1st R.	1 F.F.A., 2nd R.	31 S., 2nd R.
Nicifos	94	94	39.32	16.36	26.02
N/chalk & B. Slag	94	94	35.95	15.20	24.00
S. of Amm.	94	—	37.65	15.88	24.61
Nitrochalk	94	—	35 68	16.32	22.99
S. Amm. & Super-phosphate	94	94	—	15.01	24.69
S. Amm. & B. Slag	94	94	—	15.47	24.51
Sig. Diff. 20 : 1			3.25	—	—

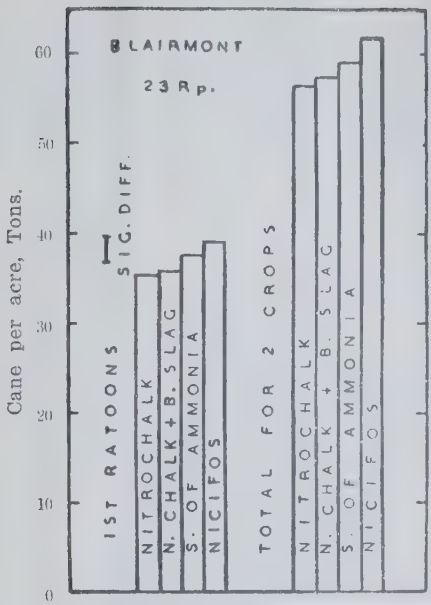


FIG. IX.—**Effect of Nitrogenous and Phosphatic Manures on P.O.J. 2878 on Flood-fallowed Frontland.**

(A 10—A 12) SULPHATE OF AMMONIA ON PEGASSY CLAY (SECOND AND THIRD RATOONS, P.O.J. 2878).

Fields 21 Gv., Wales; 43 E., Uitvlugt; and 4 P., Cane Grove.

(*Plant cane results reported in Sugar Bulls. No. 7, p. 79 and No. 8, p. 67.*)
(*First and second ratoon results reported in Sugar Bull. No. 9, p. 35.*)

From Table XVI it will be seen that at Wales and at Cane Grove, no benefit was obtained from applying more than 4 cwt. per acre of ammonium sulphate, indeed the heavier doses had a depressing effect at Wales. At Uitvlugt, 6 cwt. per acre proved definitely better than 4 cwt. The effects at Wales and Cane Grove are unusual since past experiments of this nature have usually followed the Uitvlugt pattern (see also A 13, below). The results of the two statistically significant experiments are illustrated in Figure X.

TABLE XVI.—Effect of Sulphate of Ammonia on Second and Third Ratoons of P.O.J. 2878 on Pegassy Clay.

Sulphate of Ammonia, Cwt. per Acre.	Mean Yields in Tons Cane per Acre at		
	21 Gv., 2nd R.	43 E., 2nd R.	4 P., 3rd R.
4	34.10	25.03	24.58
6	32.68	27.44	23.25
8	31.37	28.02	24.34
Sig. Diff. 20:1	2.53	2.38	—

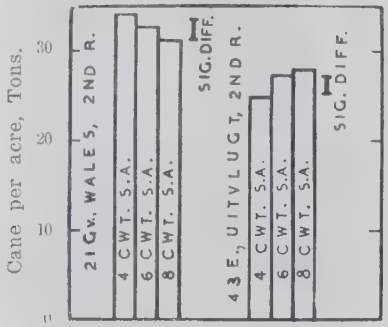


FIG. X.—Effect of Sulphate of Ammonia on P.O.J. 2878 on Pegassy Clay.

(A 13) NITROGENOUS AND POTASSIC MANURES ON PEGASSY CLAY (PLANT CANES, P.O.J. 2878).

Field 68 E., Leonora.

Soil analysis indicates this area to be fairly well supplied with potash, and from the results of the test, shown in Table XVII and Figure XI, it is clear that potassic dressings cannot be advised. However, it is obvious that the cane there can utilise more than 3 cwt. per acre ammonium sulphate or cyanamide, and that between these two there are no significant differences as sources of nitrogen.

TABLE XVII.—Effect of Nitrogenous and Potassic Manures on Plant Canes of P.O.J. 2878 on Pegassy Clay.

K_2O per Acre.	Mean Yields in Tons Cane per Acre at 68 E.					
	Sulphate of Ammonia.		Cyanamide.		Mean.	Sig. Diff. 20 : 1
	3 Cwt./ Acre.	6 Cwt./ Acre.	3 Cwt./ Acre.	6 Cwt./ Acre.		
No Potash	24.89	29.85	25.81	31.46	28.00	—
112 lb. as Sulphate of Potash	28.61	31.57	25.00	28.18	28.34	—
112 lb. as Muriate of Potash	27.14	32.07	24.66	31.56	28.86	—
Mean	26.88	31.16	25.16	30.40	28.40	4.58

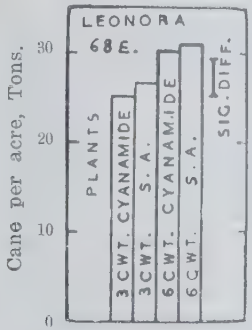


FIG. XI.—Effect of Nitrogenous Manures on P.O.J. 2878 on Pegassy Clay.

SUB-SECTION B.—PHOSPHATIC MANURES.

As stated in the introduction to the manurial section, certain phosphatic responses have been dealt with under A 6 to A 9.

(B 1—B 3) SUPERPHOSPHATE OF LIME ON FLOOD-FALLOWED FRONTLAND (PLANT CANES AND FOURTH RATOONS, P.O.J. 2878).

Fields 7 B.L., Blairmont; 81 R.H., Rose Hall; and 26 Rp., Blairmont.

(*Plant cane results reported in Sugar Bull. No. 6, p. 82.*)
(*First ratoon results reported in Sugar Bull. No. 7, p. 94.*)
(*Second ratoon results reported in Sugar Bull. No. 8, p. 69.*)
(*Third ratoon results reported in Sugar Bull. No. 9, p. 40.*)

The yields from these tests are presented in Table XVIII. No significant responses were obtained from the plants in Field 7 B.L., Blairmont, or from

the fourth ratoons in Field 81 R.H., Rose Hall, although in the latter case there were indications of a beneficial effect. In Field 26 Rp., Blairmont, the definite response obtained in the two previous crops was maintained in the fourth ratoons as a residual effect from dressings given the first four crops of the cycle. This field has now been replanted and the experiment is being continued on the same plots except that the three levels of nitrogen have been replaced by three levels of limestone. The fourth ratoon results and the total effect of four phosphate applications in the five-crop cycle are illustrated in Figure XII.

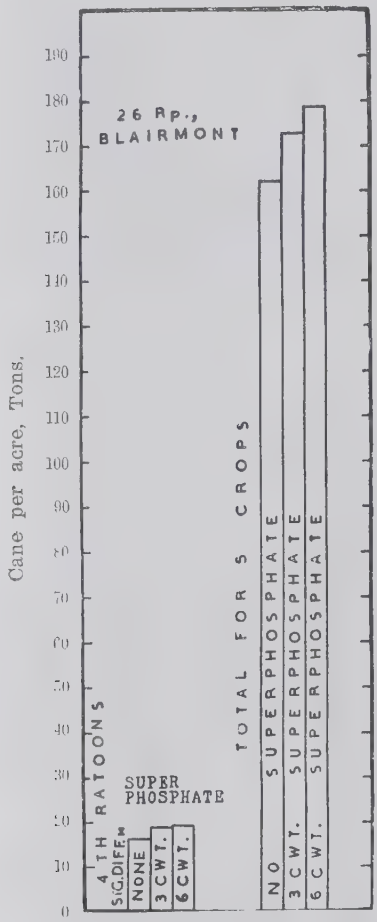


FIG. XII.—**Effect of Superphosphate of Lime on P.O.J. 2878 on Flood-fallowed Frontland.**

TABLE XVIII.—**Effect of Superphosphate of Lime on Plant Canes and Fourth Ratoons of P.O.J. 2878 on Flood-fallowed Frontland.**

Superphosphate of Lime, Cwt./Acre.	Mean Yields in Tons Cane per Acre at		
	7 B.L., Plants.	81 R.H., 4th R.	26 Rp., 4th R.*
0	47.13	26.95	16.34
2	52.13	—	—
3	—	29.95	19.06
4	45.71	—	—
6	50.35	30.25	19.13
8	44.82	—	—
Sig. Diff. 20:1	—	—	2.02

* Residual Effect.

(B 4) ROCK PHOSPHATE ON FLOOD-FALLOWED FRONTLAND (PLANT CANES, P.O.J. 2878).

Field 35 A., Port Mourant.

Although this site is deficient in available phosphate, it will be seen from Table XIX that no response was obtained from the dressings of rock phosphate. Heavier applications have been made to the first ratoons and an effort made to place the fertiliser deeper in the soil.

TABLE XIX.—**Effect of Rock Phosphate on Plant Canes of P.O.J. 2878 on Flood-fallowed Frontland.**

Rock Phosphate Cwt. 'Acre	Mean Yields in Tons Cane per Acre at 35 A.
0	37.15
3	35.54
6	35.48
9	37.04
Sig. Diff. 20 : 1	—

(B 5—B 9) BASIC SLAG ON PEGASSY CLAY (PLANT CANES, P.O.J. 2878 AND DIAMOND 10, SECOND AND THIRD RATOONS, P.O.J. 2878).

Fields 65 E., Leonora; 93 G.D., Diamond; 21 Gv., Wales; 43 E., Uitvlugt; and 4 P., Cane Grove.

(*Plant cane results reported in Sugar Bulls. No. 7, p. 96, and No. 8, p. 70.*)
(*First and second ratoon results reported in Sugar Bull. No. 9, p. 41.*)

Table XX presents the results from these five trials and Figure XIII those of the tests at Diamond and Uitvlugt which gave significant responses. Field 65 E., Leonora, is low in available phosphate but, owing to the patchy nature of the soil and the unsatisfactory climatic conditions, yields were low

and the increments attributable to phosphatic manuring were not quite statistically significant. It is of interest to note that despite the presence of 296 p.p.m. available (Truog) phosphate in the topsoil of Field 93 G.D., Diamond, a significant response was obtained from basic slag. On the other hand, the sites at Fields 21 Gv., Wales, and 4 P., Cane Grove, which have 196 and 50 p.p.m., respectively, did not benefit significantly from phosphatic manuring. Field 43 E., Uitvlugt, with 63 p.p.m. available phosphate, has now given a beneficial response to phosphates in three harvests.

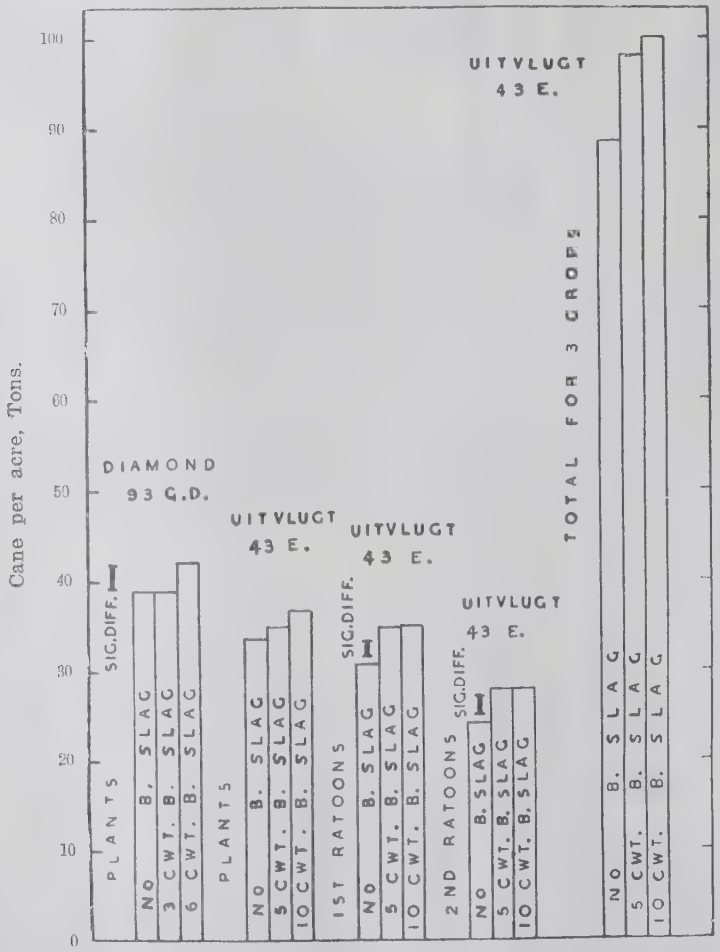


FIG. XIII.—Effect of Basic Slag on Diamond 10 and P.O.J. 2878 on Pegassy Clay.

TABLE XX.—**Effect of Basic Slag on Plant Canes of P.O.J. 2878 and Diamond 10, and Second and Third Ratoons of P.O.J. 2878 on Pegassy Clay.**

Basic Slag, Cwt., Acre.	Mean Yields in Tons Cane per Acre at				
	65 E., Plants P.O.J. 2878	93 G.D., Plants Diamond 10.	21 Gv., 2nd R.	43 E., 2nd R.	4 P., 3rd R.
0	16.23	38.96	31.82	24.26	24.42
3	19.17	39.05	—	—	—
5	—	—	32.68	28.15	23.63
6	21.14	42.19	—	—	—
10	—	—	33.65	28.07	24.12
Sig. Diff. 20:1	—	3.01	—	2.38	—

(B 10) ROCK PHOSPHATE AND BASIC SLAG ON PEGASSY CLAY (PLANT CANES, P.O.J. 2878).

Field 35 Y.R., Wales.

Table XXI and Figure XIV show that there was a definite response to phosphatic manuring at this site. Unfortunately, the unfavourable weather had a very adverse effect on yield.

TABLE XXI.—**Effect of Rock Phosphate and Basic Slag on Plant Canes of P.O.J. 2878 on Pegassy Clay.**

Treatments per Acre.	Mean Yields in Tons Cane per Acre at 35 Y.R.
Nil	10.39
3 Cwt. Rock Phosphate	12.42
6 „ „ „	14.21
9 „ „ „	13.57
6 „ Basic Slag	12.34
Sig. Diff. 20 : 1	2.46

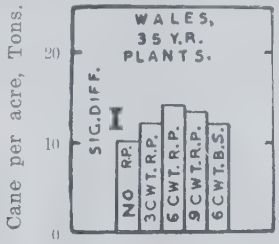


FIG. XIV.—**Effect of Rock Phosphate and Basic Slag on P.O.J. 2878 on Pegassy Clay.**

SUB-SECTION C.—POTASSIC MANURES.

As stated in the introduction to the manurial section, the effect of certain potassic dressings are also discussed under A 13.

(C 1—C 2) Sulphate of Potash on Flood-fallowed Frontland (Fourth Ratoons, P.O.J. 2878).

Fields 81 R.H., Rose Hall; and 26 Rp., Blairmont.

(*Plant cane results reported in Sugar Bull. No. 6, p. 87.*)
(*First ratoon results reported in Sugar Bull. No. 7, p. 100.*)
(*Second ratoon results reported in Sugar Bull. No. 8, p. 74.*)
(*Third ratoon results reported in Sugar Bull. No. 9, p. 43.*)

Table XXII and the results of previous harvests indicate that potassic manuring cannot be advised for either of these sites.

TABLE XXII.—Effect of Sulphate of Potash on Fourth Ratoons of P.O.J. 2878 on Flood-fallowed Frontland.

Sulphate of Potash, Cwt. per Acre.	Mean Yields in Tons Cane per Acre at	
	81 R.H.	26 Rp.*
0	30.12	18.94
2	29.11	17.84
4	27.92	17.75
Sig. Diff. 20 : 1	—	—

* Residual Effect.

(C 3—C 4) Sulphate and Muriate of Potash on Pegassy Clay (Second Ratoons, P.O.J. 2878).

Fields 21 Gv., Wales; and 43 E., Uitvlugt.

(*Plant cane results reported in Sugar Bull. No. 8, p. 76.*)
(*First ratoon results reported in Sugar Bull. No. 9, p. 44.*)

The results of these tests appear in Table XXIII. It is of interest to note that although the potash content of the topsoils of both sites are identical, with a little less potash in the subsoil of Field 43 E., Uitvlugt, this field has responded significantly to potassic manuring in all three crops (see Figure XV) whereas there has been no response from Field 21 Gv., Wales.

TABLE XXIII.—Effect of Sulphate and Muriate of Potash on Second Ratoons of P.O.J. 2878 on Pegassy Clay.

Potash Treatments.	Potash, Lb. per Acre.	Mean Yields in Tons Cane per Acre at	
		21 Gv.	43 E.
Nil	—	32.60	25.20
Sulphate	110	32.92	27.71
Muriate	110	32.63	27.58
Sig. Diff. 20 : 1		—	2.38

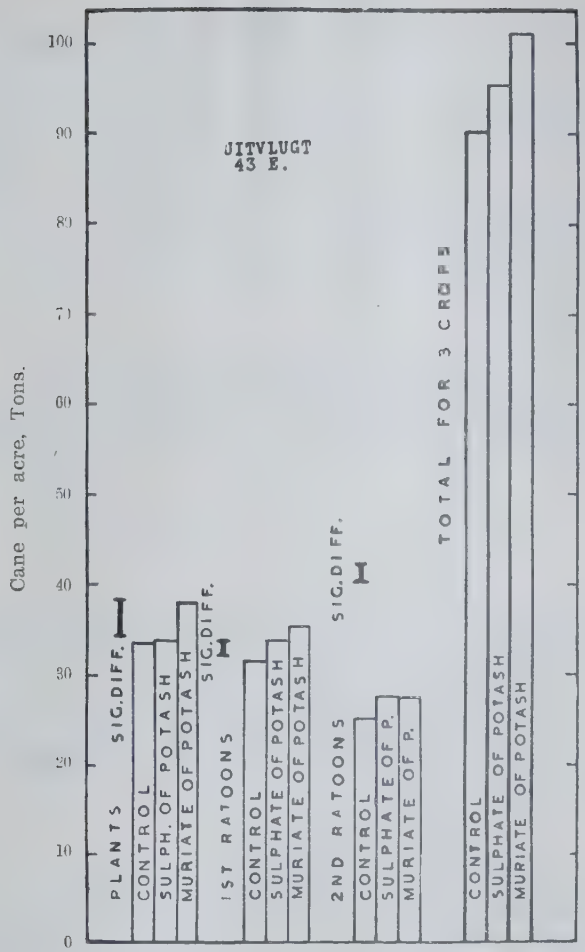


FIG. XV.—**Effect of Sulphate and Muriate of Potash on P.O.J. 2878 on Pegassy Clay.**

(C 5—C 7) SULPHATE OF POTASH ON PEGASSY CLAY (PLANT CANES, P.O.J. 2878 AND DIAMOND 10, AND THIRD RATOONS, P.O.J. 2878).

Fields 65 E., Leonora; 93 G.D., Diamond; and 4 P., Cane Grove.

(Plant cane results reported in Sugar Bull. No. 7, p. 101.)
(Second ratoon results reported in Sugar Bull. No. 9, p. 46.)

It will be seen from Table XXIV, that none of the three experiments gave any significant response to potassic manuring. This result from Field 4 P., Cane Grove, is puzzling since there was a marked response in the second ratoons.

TABLE XXIV.—**Effect of Sulphate of Potash on Plant Canes of P.O.J. 2878 and Diamond 10, and Third Ratoons of P.O.J. 2878 on Pegassy Clay.**

Sulphate of Potash, Cwt. per Acre.	Mean Yields in Tons Cane per Acre at		
	65 E., Plants P.O.J. 2878.	93 G.D., Plants Diamond 10.	4 P., 3rd R. P.O.J. 2878.
0	17.30	40.46	24.91
2	19.76	38.92	22.28
4	19.49	40.81	24.98
Sig. Diff. 20:1	—	—	—

SUB-SECTION D.—LIMING MATERIALS.

(D 1—D 2) LIMING MATERIALS ON FLOOD-FALLOWED FRONTLAND (PLANT CANES AND FIRST RATOONS, P.O.J. 2878).

Field 71 B.L., Blairmont; and 31 K., Albion.

(*Plant cane results reported in Sugar Bull. No. 9, p. 48.*)

These tests form part of a chain designed to determine the effects of a moderate dressing of lime or limestone at each replanting. They have already been through a complete cycle (the results from which showed no significant effects from the applications) and the data in Table XXV are from the second cycle. Neither in the plants at Blairmont nor in the first ratoons at Albion were the differences significant, although at the latter site there had been a definite beneficial effect from liming in the plant canes.

TABLE XXV.—**Effect of Liming Materials on Plant Canes and First Ratoons of P.O.J. 2878 on Flood-fallowed Frontland.**

Treatments per Acre.	Mean Yields in Tons Cane per Acre at					
	71 B.L., Plants.		31 K., 1st R.		Total for 2 Crops at 31 K.	
Control	40.77	40.77	36.38	36.38	56.31	56.31
½ Ton Lime	42.07		36.84		59.97	
1 „ „	42.75		38.08		60.77	
½ „ Limestone	40.81		35.35		59.86	
1 „ „	42.68		36.06		60.33	
Lime and Limestone		42.08		36.58		60.23
Sig. Diff. 20 : 1	...	...	...	...	...	...

(D 3) Ground Limestone on Flood-Fallowed Frontland (Plant Canes, P.O.J. 2878).

Field 7 B.L., Blairmont.

This trial was designed by Mr. L. S. Birkett, Chemist of Blairmont Estate, with a view to testing considerably heavier dressings of limestone than those used in D 1—D 2, above, but it will be seen from Table XXVI that no significant response was secured in the plant canes.

Table XXVI.—**Effect of Ground Limestone on Plant Canes of P.O.J. 2878 on Flood-fallowed Frontland.**

Treatments per Acre.	Mean Yields in Tons Cane per Acre at 7 B.L.
Control	49.95
2 Tons Limestone	48.69
4 „ „	48.82
6 „ „	46.14
8 „ „	50.02
Sig. Diff. 20:1	—

(D 4—D 5) Limestone on Pegassy Clay (Plant Canes, P.O.J. 2878 and Diamond 10).

Fields 65 E., Leonora; and 93 G.D., Diamond.

The results of these two tests are shown in Table XXVII, and the significant response secured at Field 65 E., Leonora, illustrated in Figure XVI. The degree of soil acidity is very similar at both sites but the Leonora field is more pegassy than the one at Diamond and there have been indications in the past that the more pegassy soils respond more readily to dressings of limestone.

Table XXVII.—**Effect of Limestone on Plant Canes of P.O.J. 2878 and Diamond 10 on Pegassy Clay.**

Limestone, Tons per Acre.	Mean Yields in Tons Cane per Acre at	
	65 E., P.O.J. 2878.	93 G.D., Diamond 10.
0	15.47	38.96
1	18.97	41.29
2	22.11	39.96
Sig. Diff. 20:1	6.63	—

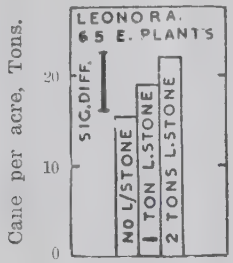


FIG. XVI.—**Effect of Limestone on P.O.J. 2878 on Pegassy Clay.**

SUB-SECTION E.—DISCUSSION AND SUMMARY.

Nitrogenous Manures.

The testing of substitutes for ammonium sulphate, which might have been considered as only of academic interest before the war, has now become an important issue and it is fortunate that it had received some attention before.

Six comparisons with nitrochalk, three with cyanamide and one with sodium nitrate indicate that, so far as the immediate effect on yield is concerned, these, as sources of nitrogen, are as efficient as ammonium sulphate. Similar findings have been recorded in previous Bulletins of this series, but some of the more recent results may have been affected by the failure of the cane, under very unfavourable weather conditions, to use all the nitrogen supplied, and to put the question beyond all doubt and in order to gain further information as to the effect of the various fertilisers on soil changes, considerable expansion of this phase of the work is already under way.

An area of virgin pegassy clay in the Edinburgh section of Pln. Leonora gave a definitely higher yield from six than from three cwt. per acre of ammonium sulphate or cyanamide. Most of the tests on pegassy clay in the past, and one here recorded on second ratoons at Field 43, E., Uitvlugt, have followed this pattern and indicated 5—6 cwt. as an optimum dose, but other tests at 21 Gv., Wales, and 4 P., Cane Grove, reported in this Bulletin, have not profited from dressings of over 4 cwt. It is felt that these unusual results, and the failure of fourth ratoons on flood-fallowed frontland in Field 81 R.H., Rose Hall, to respond to more than 2 cwt./acre, may be largely attributable to the very abnormal weather conditions.

Phosphatic Manures.

As foreshadowed in previous Bulletins, more attention is being given to investigations with phosphates, both in the laboratory and the field. Mr. C. L. C. Bourne has found that, under laboratory conditions, the phosphate-fixing power of the local sugar soils is very high and he suspects that much of

the failure to obtain a field response to phosphatic dressings is due to the fertiliser being fixed outside the zone of root activity. This is substantiated by the higher number of positive responses recorded from tests on pegassy clay, where penetration is possibly quicker and deeper, than from those on flood-fallowed frontland. Thus the pegassy clay at 93 G.D., Diamond, with 296 p.p.m. of available (Truog) phosphate in the topsoil responded definitely to phosphatic manuring, whereas no response was obtained on the flood-fallowed frontland at 35 A., Port Mourant, where the available phosphate only amounts to 10 p.p.m. In consequence, recent phosphatic applications at three sites on the heavier soils have been made with the help of crowbars piercing holes to a depth of nine inches.

No general picture of the phosphate requirements of our soils can be given until many more experiments have been harvested, but it is now possible to say that :

1. The pegassy clay responds more readily than the frontland, the response in some instances being very obvious on simple inspection of the plots;
2. Curacao rock phosphate can be used in place of basic slag or superphosphate;
3. Nicifos (18 : 18) is also a very satisfactory source of phosphate; and, for the benefit of individual estates, to advise phosphatic manuring on:

   The north half of Cane Grove (tests carried out in Melville, South Diamond and Uplands sections);

   Fields 23 and 26 Rp. and 12 O., Blairmont;

   Field 1 L., Bath;

   Field 13 R., Port Mourant;

   Field 93 G.D., Diamond;

   Fields 10 C., and 35 Y.R., Wales;

   Fields 65 E., and 43 Gv., Leonora;

   Fields 31 E., and 43 E., Uitvlugt.

Potassic Manures.

As with phosphates, no general picture can as yet be given for potassic manuring for the Colony and, on account of the relatively small areas which respond to potash, the high cost of potassic manures and the difficulty of obtaining these, the problem is receiving less attention than the more urgent ones of substitutes for ammonium sulphate and phosphatic manuring, but it is possible to advise that definite responses are likely to be secured from potassic applications to :

Field 86 G.D., Farm;

Fields 31, 41 and 43 E., and 93 M.Z., Uitvlugt.

Liming Materials.

There are some indications, not statistically significant, however, that moderate (½ to 1 ton/acre) dressings of liming materials at each replanting, on flood-fallowed frontland, may lead to slight increases in yield, but no definite statement can, as yet be made. On the other hand, dressings of limestone up to 8 tons/acre failed to produce any significant increment in the plants on frontland at Blairmont.

On virgin pegassy clay at Leonora, 2 tons of limestone gave a significant increase in the plant cane yield, confirming two previous experiments (at 75 Z., Uitvlugt and 86 G.D., Farm) which indicated that limestone dressings have a definite beneficial effect on yield on this soil type.

It is possible that the differential response to liming on the two soil types is related to the question of placement and ease of penetration, and advantage is being taken of the new deep-drill method of cultivation to test the value of getting limestone well below the surface in the frontland clays.

APPENDIX I.

SOILS OF MANURIAL TRIAL SITES.*

Plantation :—	PORT MOURANT.		PROVIDENCE, B.		BLAIRMONT.		DIAMOND.		LEONORA.				WALES.	
Field No. :—	35 Ankerville.		18 Glasgow West.		23 Rampoor.		93 Great Diamond.		65 Edinburgh.		68 Edinburgh.		35 Young Rachel.	
Sample No. :—	B. 736	B. 737	B. 742	B. 743	B. 759	B. 760	D. 1904	D. 1905	D. 1927	D. 1928	D. 1939	D. 1940	D. 1931	D. 1932
Sampling Depth :—	0—1 ft.	1—2 ft.	0—1 ft.	1—2 ft.	0—1 ft.	1—2 ft.	0—1 ft.	1—2 ft.	0—1 ft.	1—2 ft.	0—1 ft.	1—2 ft.	0—1 ft.	1—2 ft.
Normal pH	5.69	6.15	4.77	4.77	5.23	5.38	4.71	4.64	4.66	4.34	4.36	3.87	4.39	4.31
Exchange pH	4.31	4.83	3.63	3.73	3.99	4.48	3.89	3.82	3.83	3.62	3.70	3.41	3.97	3.70
% Soluble Salts	.027	.071	.023	.047	.031	.117	.033	.026	.037	.027	.032	.053	.030	.037
% Organic Matter	3.24	1.68	3.90	2.08	3.44	2.02	4.92	3.13	9.30	6.30	10.52	7.68	14.45	15.79
Avail. P_2O_5 p.p.m. (Truog)	10	<10	15	15	<10	10	296	104	19	14	20	12	15	11
Exch. and water sol. Potash, mg. eqs. /100 gms.	...	...	...	...	...	...	.24	...	.96	...	.79	...	.39	...

* The data for sites mentioned in this Bulletin and not printed here will be found in the Bulletin presenting the first plant cane results from such sites.

THE VARIETY AND FERTILISER POSITION OF THE SUGAR INDUSTRY, VII.

By

C. HOLMAN B. WILLIAMS,

Sugar Agronomist and Plant Breeder.

VARIETAL COMPOSITION OF THE 1941 HARVESTS.

Table I and Figure I are compiled from the returns kindly supplied by the estates and show the relative importance, by area, of the varieties to be harvested in 1941. No variety returns are available from the small cane farmers who supply about two per cent. of the sugar output.

TABLE I.

Percentage Distribution of the Varieties to be Reaped During 1941.

Variety.	Total English Acres in the Colony.	Percentage in West Demerara.	Percentage along Demerara River Banks.	Percentage in East Demerara.	Percentage in Berbice.
P.O.J. 2878	42,961.40 (66.0%)	12.3	7.8	30.3	49.6
Diamond 10	20,262.92 (31.1%)	21.3	47.7	15.5	15.5
Other canes	1,343.50 (2.1%)	4.7	67.8	10.1	17.4
D. 625	382.33 (0.6%)	...	44.0	2.0	54.0
Mixed	151.34 (0.2%)	3.8	37.4	...	58.8
	65,101.49 (100.0%)				

There is a slight increase in the total area to be reaped, as compared with 1940, and the acreage in P.O.J. 2878 has risen still further at the expense of Diamond 10 and D. 625. There is a small rise in 'other canes', as compared with 1940, due to the commercial extension of certain promising seedlings. These include 196 acres of D. 66/30, 160 acres of D. 49/30, 159 acres of D. 166/34, 100 acres of D. 456/33, 83 acres of Co. 213 and 76 acres of D. 450/33.

Table II shows that P.O.J. 2878 is now more grown than was D. 625 in 1934, that Diamond 10 is declining in popularity after having reached a peak of 43.5 per cent. of the area in 1939, and that mixed areas have virtually disappeared.

TABLE II.

Comparison of Areas of D. 625, Diamond 10, P.O.J. 2878 and "Mixed" in the Colony During Recent Years.

Variety.	Per Cent. of Total Area in the Colony.							
	1934	1935	1936	1937	1938	1939	1940	1941
D. 625	62.5	55.4	44.6	33.0	20.6	8.0	2.8	0.6
Diamond 10	16.8	22.7	29.4	36.6	41.3	43.5	37.1	31.1
P.O.J. 2878	1.4	4.7	9.7	19.2	31.7	45.7	57.6	66.0
"Mixed"	9.5	12.6	12.7	8.8	4.0	0.8	0.6	0.2

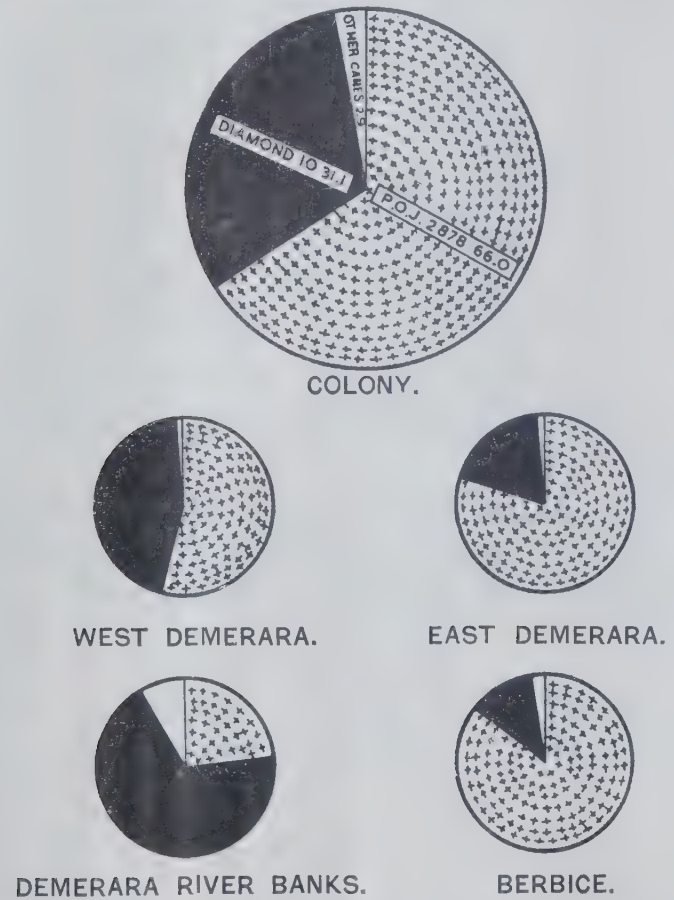


FIG. I.

Relative Varietal Composition of the Cane Areas to be Harvested in British Guiana in 1941.

COMMERCIAL TESTS WITH NEW VARIETIES.

Having made a series of careful comparisons between D. 66/30 and P.O.J. 2878, the Manager of Pln. Skeldon has kindly submitted the data on which Table III is based.

TABLE III.

Comparison of D. 66/30 and P.O.J. 2878 at Pln. Skeldon.

Cycle Age.	D. 66/30.				P.O.J. 2878.			
	Acres.	Sucrose lb. per Gallon.	Purity.	Tons Sugar/ Acre.	Acres.	Sucrose lb. per Gallon.	Purity.	Tons Sugar/ Acre.
Plants	15	1.740	85.5	6.00	15	1.583	82.1	6.00
,,	4.75	1.520	82.1	4.63	11	1.573	82.6	4.33
,,	7	1.679	85.6	5.43	7	1.508	81.6	4.71
,,	7.75	1.651	85.1	5.16	7.75	1.526	82.0	4.77
,,	7	1.721	86.2	3.50	7	1.638	83.5	3.50
,,	10.25	1.406	82.8	3.71	8.25	1.466	83.5	4.48
,,	5.75	1.903	87.2	4.35	5.75	1.604	82.2	3.83
,,	7	1.591	82.5	3.00	7	1.500	80.7	3.71
1st Ratoons	15	1.630	86.1	4.40	15	1.543	82.4	4.06
,, ,,	4.75	1.755	88.9	3.16	11	1.732	85.7	3.00
,, ,,	7	1.664	84.3	5.14	7	1.615	83.8	4.38
,, ,,	7.75	1.815	87.3	4.65	7.75	1.669	82.2	4.39
2nd Ratoons	15	1.729	86.6	4.60	15	1.773	84.9	4.13
,, ,,	4.75	1.963	89.9	3.37	11	1.917	86.6	3.24
,, ,,	7	1.737	85.5	4.29	7	1.724	83.4	4.29
,, ,,	7.75	1.732	84.7	3.74	7.75	1.737	83.6	3.87
3rd Ratoons	15	1.605	83.7	4.47	15	1.570	82.4	4.13
,, ,,	4.75	1.669	84.6	2.95	8.50	1.498	82.0	3.09
,, ,,	6	1.643	85.7	3.00	6.50	1.630	83.0	2.31

Several other commercial areas of a number of canes have been harvested during the year and reports on the results kindly sent in by the estates concerned. Yields, however, were very adversely affected by the severe drought and fluctuated greatly. They are placed on record in Table IV.

TABLE IV.

Yields of New Varieties under Estate Conditions.

Estate.	Cycle Age.	Acres Reaped.	Mean Yield Sugar/ Acre. Tons.	Estate.	Cycle Age.	Acres Reaped.	Mean Yield Sugar/ Acre, Tons.
	D. 602/22				*D. 456/33*		
Versailles	Plants	1.6	2.41	Port Mourant	Plants	7.1	3.80
,,	1st R.	11.6	2.81	Providence, B.	,,	1.6	2.54
				Versailles	,,	41.9	2.38
	D. 49/30			L. B. I.	,,	6.7	2 39
				Lusignan	,,	6.3	2.54
L. B. I.	Plants	44.1	2.13	Versailles	1st R.	1.9	2.17
Diamond	,,	37.1	2.72	Lusignan	,, ,,	4.7	2.11
Lusignan	,,	9.5	2.64				
Diamond	1st R.	22.4	2.61		*D. 166/34*		
,,	2nd R.	5.8	1.82				
Providence, B.	3rd R.	1.3	1.69	Schoon Ord	Plants	10.5	3.81
Skeldon	,, ,,	4.5	2.46	Versailles	,,	5.3	4.12
				Providence, B.	,,	2.1	3.33
	D. 66/30			Skeldon	,,	4.2	3.57
				Wales	,,	9.7	1.82
L. B. I.	Plants	3.4	4.39	Port Mourant	,,	1.5	4.82
Versailles	1st R.	2.4	3.16	Lusignan	,,	4.6	2.88
L. B. I.	,, ,,	3.4	3.80				
Diamond	,, ,,	60.1	1.80		*B.H. 10/12*		
Albion	2nd R.	1.2	1.71				
Ogle	,, ,,	2.6	1.31	Leonora	2nd R.	16.8	1.37
Blairmont	,, ,,	8.7	1.07	L. B. I.	,, ,,	2.5	1.20
L. B. I.	,, ,,	9.6	1.56				
Diamond	,, ,,	22.8	0.99		*Co. 213*		
Providence, B.	3rd R.	1.6	1.34				
Blairmont	,, ,,	8.7	1.44	Albion	Plants	24.6	3.93
				Ogle	,,	17.8	2.81
	D. 75/30			Lusignan	,,	30.5	2.79
				,,	1st R	10.5	2.85
Leonora	1st R.	2.6	3.80	Wales	,, ,,	4.2	2.14
				Albion	2nd R.	1.8	3.34
	D. 295/33			Providence, B.	,, ,,	5.3	2.96
Versailles	Plants	5.3	2.66		*S C. 12/4*		
	D. 450/33			Diamond	Plants	224.0	3.08
				Ruimveld	,,	6.8	1.74
Port Mourant	Plants	6.8	3.95	Diamond	1st R.	190.2	1.81
Versailles	,,	47.4	3.00	Ruimveld	,, ,,	7.6	0.92
L. B. I.	,,	6.4	1.71	Leonora	,, ,,	22.1	2.22
Lusignan	,,	6.3	3.17	Diamond	2nd R.	100.2	1.84
Versailles	1st R.	3.8	3.28	Ruimveld	,, ,,	10.2	0 98
Lusignan	,, ,,	4.7	2.75	Leonora	,, ,,	172.2	1.88
				Leonora	3rd R.	5.6	1.96
	R.P. 20/31						
Leonora	1st R.	5.3	1.14				

FERTILISERS IN 1940.

Table V, adapted from the Reports of the Comptroller of Customs, shows the fertiliser imports for the past ten years. In 1940 the imports of nitrogenous manures and of manurial lime (ground limestone) both reached record levels, surpassing previous figures by wide margins. There was, on the other hand, a further decline in the imports of 'other fertilisers'. It should be noted that, for the first time in very many years, the imports of nitrogenous fertilisers included a large shipment of sodium nitrate.

The estates have kindly supplied details as to the various manures used in 1940 and the data for 1938 to 1940 are summarised in Table VI. The Rock Phosphate, which appears in Table VI for the first time, is a product of Curaçao, Netherlands West Indies.

The 1940 returns are graphically presented in Figure II.

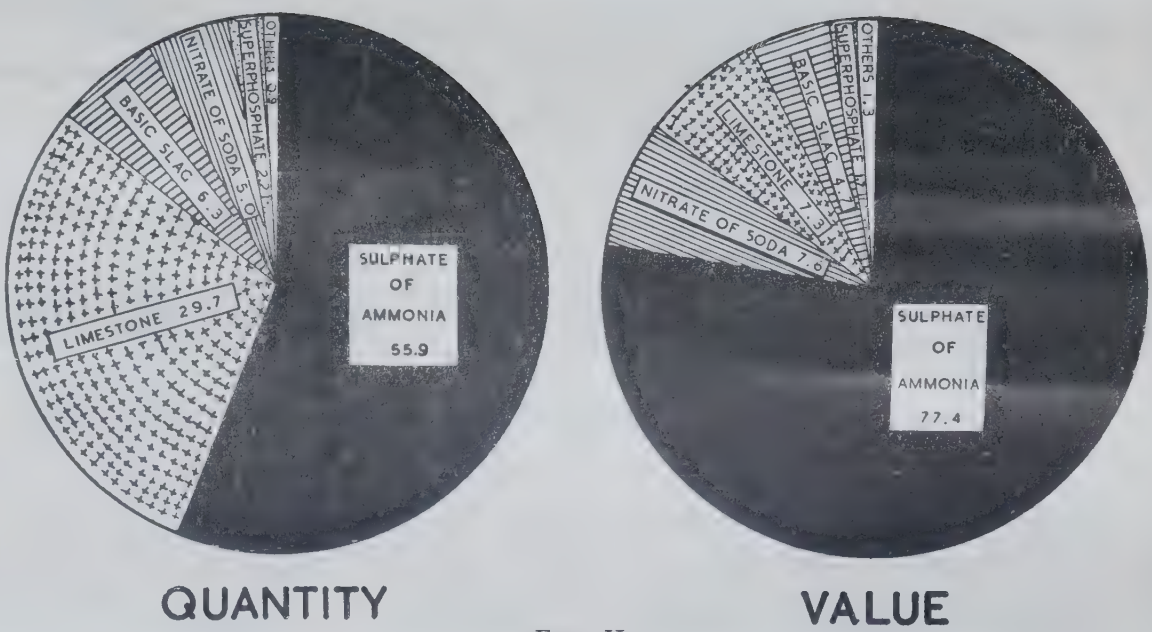


FIG. II.

Relative Quantities and Values of Fertilisers Used on British Guiana Sugar Estates in 1940.

TABLE V.

Fertilisers Imported into British Guiana in Recent Years.

Years.	Nitrogenous Fertilisers (almost entirely Sulphate of Ammonia).			Manurial Lime and Limestone.			Other Fertilisers (mainly Superphosphate and Basic Slag with some Sulphate of Potash).			Total Imports.	
	Tons.	Value $	Value per Ton, $	Tons.	Value $	Value per Ton, $	Tons.	Value $	Value per Ton, $	Tons.	Value $
1931	7,165	249,107	34.77	3,239	32,984	10.18	3,226	83,460	25.87	13,630	365,551
1932	8,294	254,726	30.71	4,366	42,071	9.64	2,619	54,281	20.73	15,279	351,078
1933	7,681	263,456	34.30	4,749	42,569	8.96	2,937	76,617	26.09	15,367	382,642
1934	7,727	248,185	32.12	4,306	38,524	8.95	2,168	48,735	22.48	14,201	335,444
1935	10,268	333,732	32.50	4,917	39,521	8.04	3,096	60,812	19.64	18,281	434,065
1936	9,963	334,556	33.58	3,786	28,453	7.52	2,639*	52,092*	19.74	16,388	415,101
1937	11,171	367,689	32.91	4,537	33,342	7.35	2,537*	49,509*	19.51	18,245	450,540
1938	10,205	356,068	34.89	3,755	27,131	7.23	2,199*	46,821*	21.29	16,159	430,020
1939	11,720	401,847	34.29	4,795	33,609	7.01	2,033*	42,838*	21.07	18,548	478,294
1940	17,179†	1,000,526†	58.24	5,585	41,915	7.50	1,809*	54,429*	30.09	24,573	1,096,870
Mean	10,137	380,989	35.83	4,403	36,012	8.24	2,526	56,960	22.65	17,067	473,960
% of Mean Annual Imports:	59.40	80.38		25.80	7.60		14.80	12.02			

*Includes:
1936: 152 tons of Sulphate of Potash, valued at $ 6,652 or $43.76 per Ton.
1937: 160 " " " " " " " $ 6,929 or $43.31 per Ton.
1938: 234 " " " " " " " $10,196 or $43.57 per Ton.
1939: 96 " " " " " " " $ 4,155 or $43.28 per Ton.
1940: 42 " " " " " " " $ 2,795 or $66.55 per Ton.

†Includes: 1940: 1,001 tons of Nitrate of Soda, valued at $50,979 or $50.93 per Ton.

TABLE VI.

Values and Quantities of Fertilisers used on British Guiana Sugar Estates, 1938—1940.

Fertiliser.	Value, $			Per cent. of Total Value.			Per Ton, $			Quantity, Tons.			Per cent. of Total Quantity.		
	1938	1939	1940	1938	1939	1940	1938	1939	1940	1938	1939	1940	1938	1939	1940
Sulphate of Ammonia	410,057.89	424,614.86	568,986.47	82.6	81.9	77.4	40.15	40.59	58.37	10,212.47	10,460.32	9,747.12	62.6	62.1	55.8
Nitrate of Soda	...	...	55,922.71	...	...	7.6	...	...	63.87	...	...	875.53	...	...	5.0
Basic Slag	28,905.38	31,208.30	34,772.53	5.8	6.0	4.7	20 30	22 46	31.76	1,423.99	1,389.25	1,094.85	8.7	8.3	6.3
Superphosphate	12,166.14	14,107.18	12,649.56	2.5	2.7	1.7	21.54	21.75	33.68	564.85	648.60	375.57	3.5	3.9	2.1
Limestone	38,237.47	41,233.48	53,571.86	7.7	8.0	7.3	9.66	9.85	10 34	3,958.40	4,186.97	5,179.05	24.3	24.9	29.7
Sulphate of Potash	6,647.60	7,097.87	4,494.21	1.3	1.4	0.6	46.68	48.28	59.37	142.40	147.00	75.70	0.9	0.8	0.4
Rock Phosphate	...	...	2,680.70	...	...	0.4	...	...	30.66	...	...	87.42	...	...	0.5
Miscellaneous	350.84	57.83	1,670.87	0.1	...	0.3	...	...	...	5.30	0.92	29.95	...	...	0.2
TOTAL	496,365.32	518,319.52	734,748.91	100.0	100.0	100.0	...	...	...	16,307.41	16,833.06	17,465.19	100.0	100.0	100.0

SOME PRELIMINARY EXPERIMENTS ON PHOSPHATE FIXATION IN BRITISH GUIANA SUGAR CANE SOILS.

BY

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Acting Chemist.

As a result of the lack of response to phosphate fertilizers by sugar cane in field experiments conducted by the Sugar Agronomist prior to 1938, the fate of phosphorus applied to British Guiana soils became a matter of interest. In the course of a discussion on manures at a meeting of the Sugar Experiment Stations' Committee held in December 1939, Mr. Follett-Smith stated that the phosphate question had not been solved, and suggested that further information could probably be obtained in a preliminary way by laboratory experiments.

Towards the end of March, 1940, the writer was instructed to commence some experiments with various soils. This work reached a certain stage in July and certain conclusions were arrived at, but owing to circumstances over which he had no control the experiments had to cease.

In the course of the investigations a considerable amount of literature had to be consulted, and it was felt that local chemists might benefit if a summary of the conclusions by some of the foremost workers in this field was prepared and submitted to them along with the results of the laboratory experiments, but it has now been decided to submit the details of the experiments alone with the conclusions arrived at. A copy of the digest of literature on phosphate fixation is, however, available for consultation at the Laboratory.

Experiment I.

Twenty grams of air-dry clay soil (D 1,885) was transferred to a shaking bottle and one hundred ml. of water added. The bottle was shaken for one hour and the whole allowed to stand overnight, then filtered on a Buchner funnel by suction (No. 40 Whatman Filter 7 cm.), and 50 ml. of filtrate taken for the estimation of P_2O_5 colorimetrically.

Result : No P_2O_5 present.

N.B.: Soil water ratio = 1:5.

Twenty grams of soil (D. 1,885) treated as above but the 100 ml. of water contained 5 mgms. P_2O_5.

It was found that 50 ml. filtrate = $\frac{2}{100}$ of .000025 P_2O_5

= .000005 P_2O_5

i.e., 1 part in 500 P_2O_5 added remained *water soluble.*

II. Floyd Heck Method, Modified.

One half gram of soil (D. 1,885) was transferred to a 300 ml. Erlenmeyer flask, 50 ml. distilled water added and the flask placed on a hot plate regulated to boil the contents moderately until about 10 ml. of liquid remained. The flask was then transferred to the electric oven and dried out at 100°C. To the contents of the flask 200 ml. of 002 N, H_2SO_4 (buffered with ammonium sulphate to pH3) was added in three instalments, washing the material from the flask to a shaking bottle (with the aid of a rubber broom). The bottle was then shaken for 30 minutes on a shaking machine, the contents filtered through a No. 30 Whatman Filter (15 cm.), and 50 ml. taken for comparison with a standard phosphate soln. containing .000025 P_2O_5.

One half gram samples of the same soil were treated in a similar manner, but varying quantities of standard phosphate solution (to which water was added to bring the volume to 50 ml.) were added in the first stage, and suitable quantities of the filtrate taken for comparison.

The results for soil D. 1,885 and three others are tabulated as follows :—

Table I.

Soil Number	Parts per million P_2O_5			Per cent. P_2O_5 Fixed.
	Added	In Filtrate	Retained by Soil	
D. 1,885 Leonora clay	nil	90		
	200	150	140	70
	300	200	190	63
	400	240	250	62
	500	280	310	62
Diamond 1 Diamond New Land Pegasse	nil	nil		
	200	50	150	75
	300	90	210	70
	400	120	280	70
	500	140	360	72
Diamond 2 Diamond New Land Pegasse	nil	nil		
	200	35	165	82
	300	48	252	84
	400	100	300	75
	500	120	380	76
D. 534 Versailles clay	nil	50		
	200	106	144	72
	300	130	220	73
	400	180	270	67
	500	220	330	66

III. Floyd Heck Method, Modified.

Fixation of phosphate using smaller varying quantities of phosphate, with the same quantity of soil as in Experiment II, gave the results presented in Table II.

Table II.

Soil Number	Parts per million P_2O_5			Per cent. P_2O_5 Fixed.
	Added	In Filtrate	Retained by Soil	
B. 267 clay	nil	nil		
	50	20	30	60
	100	40	60	60
	150	60	90	60
	200	80	120	60
	500	200	300	60

IV. A number of soils and subsoils were tested by the Floyd Heck method using 500 p.p.m. P_2O_5 for the fixation test. The results are recorded in Table III.

TABLE III.

Soil Number.	Parts per million P_2O_5.			Per cent. P_2O_5 Fixed.
	Added.	In Filtrate.	Retained by Soil.	
B. 70 Providence NDP No. 32	nil	80		
0-6 in. pegasse	500	320	260	52
B. 71 Subsoil grey clay	nil	nil		
	500	240	260	52
B. 72 Topsoil pegasse	nil	80		
	500	320	260	52
B. 73 Subsoil clay	nil	nil		
	500	170	330	66
B. 93 Blairmont No. 1 R.P. clay	nil	40		
	500	130	410	82
B. 94 Subsoil	nil	nil		
	500	120	380	76
B. 95 Blairmont No. 1 R.P. clay	nil	70		
	500	140	430	86
B. 96 Subsoil	nil	30		
	500	140	390	78
B. 224 Blairmont 71 Bush Lot clay	nil	50		
	500	224	326	65
B. 225 Subsoil	nil	20		
	500	200	320	64
B. 267 Skeldon 8 Springlands clay	nil	nil		
	500	200	300	60
B. 268 Subsoil	nil	nil		
	500	220	280	56
B. 376 Blairmont 26 Rampoor clay	nil	20		
	500	280	240	48
B. 377 Subsoil	nil	nil		
	500	272	228	46
B. 394 Rose Hall 81 Rose Hall clay	nil	50		
	500	272	278	56
B. 395 Subsoil clay	nil	80		
	500	300	280	56
B. 549 Port Mourant 20 Resource clay	nil	30		
	500	280	250	50
B. 550 Subsoil clay	nil	50		
	500	268	282	56
B. 553 Albion 23 Belvedere clay	nil	nil		
	500	140	360	72
B. 554 Subsoil clay	nil	nil		
	500	150	350	70
D. 685 Uitvlugt 30 W 0-6 in. Pegasse profile	nil	220		
	500	500	220	44
D. 686 „ 6-12 in.	nil	200		
	500	500	200	40
D. 687 „ 12-18 in.	nil	20		
	500	312	208	42
D. 688 „ 18-24 in.	nil	20		
	500	288	232	46
D. 1,020 Ogle 45 Ogle A.R. clay	nil	60		
	500	200	360	72
D. 1,021 Subsoil clay	nil	20		
	500	200	320	64
D. 1,277 Cane Grove 36 Diamond South pegassy clay	nil	30		
	500	216	314	63
D. 1,278 Subsoil pegassy clay	nil	nil		
	500	200	300	60
D. 1,364 Uitvlugt 31 East clay	nil	100		
	500	360	240	48
D. 1,365 Subsoil clay	nil	20		
	500	312	208	42
D. 1,444 L.B.I. 15 Felicity clay	nil	70		
	500	240	330	66
D. 1,445 Subsoil clay	nil	40		
	500	240	300	60
D. 1,505 Uitvlugt 43 East pegasse	nil	100		
	500	280	320	64
D. 1,506 Subsoil clay	nil	50		
	500	280	270	54
D. 888 Uitvlugt 33 East Topsoil composite 0-1 ft. pegassy clay	nil	100		
	500	400	200	40
E. 526 Anchor Ranch	nil	20		
	500	260	260	52
E. 527 „ „	nil	nil		
	500	268	232	46
E. 553 Cuyuni River Popeka	nil	nil		
	500	130	370	74
F. 554 „ „	nil	nil		
	500	60	440	88
B. 686 Anchor Ranch 0-6 in.	nil	nil		
	500	280	220	44
B. 687 6-12 in.	nil	nil		
	500	280	220	44
B. 690, 0-6 in.	nil	nil		
	500	400	100	20
B. 691, 6-12 in.	nil	nil		
	500	340	160	32
B. 694, 0-6 in.	nil	nil		
	500	400	100	20
B. 695, 6-12 in.	nil	nil		
	500	400	100	20
B. 698, 0-6 in.	nil	nil		
	500	260	240	48
B. 699, 6-12 in.	nil	nil		
	500	280	220	44
N.W.C.P. I Pegasse composite	nil	100		
	500	400	200	40
N.W.C.P. XXVII Lateritic clay	nil	nil		
	500	50	450	90
B. 706 Anchor Ranch	nil	nil		
	500	260	240	48
B. 707 „ „	nil	nil		
	500	280	220	44
L. 1 Leonora New Land North Section	nil	20		
	500	160	360	72
L. 2 „ „ Subsoil	nil	nil		
	500	180	320	64
L. 3 Mid Section	nil	20		
	500	160	360	72
L. 4 Subsoil	nil	20		
	500	160	360	72
L. 5 South Section	nil	20		
	500	280	240	48
L. 6 Subsoil	nil	20		
	500	200	320	64
Diamond 1 Diamond New Land Topsoil	nil	nil		
	500	140	360	72
Diamond 2 Topsoil	nil	nil		
	500	120	380	76

V. Phosphate Fixation Experiments on Limed Soils.

To 10-gram portions of air-dry soil, passing a 1 mm. sieve, varying quantities of ground limestone were added, stirred in dry condition and then 40 ml. distilled water added and allowed to dry out in the laboratory in a place free from dust. The dry soil was transferred to a porcelain mortar and thoroughly mixed with a rubber pestle. Two half-gram samples were taken for experiment by the Floyd Heck method and the pH determined on the remainder. The data obtained appear in Table IV.

Table IV.

Ground Limestone Added.		pH.		Parts per million P_2O_5.			Per cent. P_2O_5 Fixed.
Gm.	Tons per ac. 6 in.	Normal.	Exchange.	Added.	In Filtrate.	Retained by Soil.	
D. 1,885							
Nil		4.18	3.70	nil	120		
				500	300	320	64
.011	2	4.44	3.86	nil	108		
				500	300	308	62
.022	4	4.58	3.90	nil	92		
				500	300	292	58
.055	10	5.12	4.38	nil	120		
				500	300	320	64
.110	20	6.34	5.74	nil	108		
				500	300	308	62
Leonora I.							
nil		4.07	3.70	nil	20		
				500	160	360	72
.022	4	4.44	3.86	nil	20		
				500	160	360	72
.044	8	4.68	4.04	nil	20		
				500	160	360	72
.110	20	6.04	5.44	nil	20		
				500	160	360	72
.220	40	7.05	6.65	nil	20		
				500	160	360	72
.303	60	7.28	6.80	nil	20		
				500	160	360	72
D. 534							
nil		4.56	3.60	nil	50		
				500	216	334	67
.022	4	4.97	3.94	nil	40		
				500	220	320	64
.044	8	5.77	4.75	nil	44		
				500	220	324	65
.110	20	7.27	6.53	nil	54		
				500	232	322	64
.220	40	7.52	6.83	nil	60		
				500	232	328	65
.330	60	7.56	6.90	nil	60		
				500	232	328	65

VI. Effect of Saturating a Soil with Calcium and its Capacity Afterwards to fix Phosphorus in Difficultly Available Form.

Twenty grams each of five soils were taken and leached with one litre of $\frac{N}{4}$ acetic acid. The exchangeable calcium thus leached out was determined with the following results :—

Exchangeable CaO

Mg. Equivalents for 100 grm. original soil.

D 534—Pln. Versailles	
O—1 ft. Brown clay	3.17
D 888—Pln. Uitvlugt 33 E.	
O—1 ft. Pegassy clay composite	3.31
D 1885—Pln. Leonora SVA	
Topsoil clay	1.91
NWCPI—Composite pegasse	6.02
NWCPXXVII—Lateritic clay	0.70

The soils on the filters were then washed twice with distilled water and then leached with 400 ml. $\frac{N}{2}$ neutral calcium acetate solution. The soils were then washed by leaching with 200—300 ml. distilled water until filtrate showed no appreciable reaction for lime with saturated ammonium oxalate soln. They were then allowed to dry in the air, transferred to beakers, thoroughly mixed with a rubber pestle, and half-gram samples taken for phosphate fixation tests by the Floyd Heck method.

The phosphate fixation results were as follows :—

Table V.

Soil Number	Parts per million P_2O_5			Limed Soil	Untreated Soil
	Added	In Filtrate	Retained by soil	Per cent. P_2O_5 Fixed.	Per cent. P_2O_5 Fixed.
D 534		50			
	500	220	330	66	66
D 888		100			
	500	400	200	40	40
D1885		90			
	500	320	270	54	62
NWCPI		70			
	500	400	170	34	40
NWCPXXVII		nil			
	500	60	440	88	90

The remarks by Ravikovitch, a worker in Palestine, that in some cases the amount of PO_4 absorbed by H-soils equals that absorbed by Ca-soils from solutions of identical concentrations seem to be borne out by this experiment and the previous one.

VII. Beater's Method of Estimating Phosphate Fixation. First Stage.

Four samples of 10 grams each of a heavy clay soil from a rice field profile were treated as follows :—

To the soil in a 300 Erlenmeyer flask, 100 ml. of water containing four mgm. of P_2O_5 as $(NH_4)_2HPO_4$, were added and refluxed for 30 minutes, filtered and P_2O_5, estimated in the filtrate colorimetrically. The results were as under :—

Table VI.

Soil No.	Depth	Parts per million P_2O_5			Per cent. P_2O_5 Fixed.
		Added	In Filtrate	Retained by Soil	
D 1521	Top 6"	400	nil	400	100
1522	6"–12"	400	nil	400	100
1523	12"–18"	400	52	348	87
1524	18"–24"	400	83	317	79

It is interesting to note that the fixation power of this soil diminished from the surface downwards.

VIII.—Phosphate Fixation Experiment Beater's Method (Modified).

Ten grams of air-dry soil, passing 1 mm. sieve, were transferred to a 300 ml. Erlenmeyer flask and to this was added 100 ml. water containing 1 grm. citric acid. The flask was attached to a reflux condenser and the contents heated for 30 minutes, cooled and filtered on a Buchner funnel through a 7 cm. No. 40 Whatman filter, pouring back the first 20 to 30 ml. When the whole had been filtered it was shaken and 5 ml. transferred to a 100 ml. silica dish, 0.5 ml. of 10% calcium acetate soln. added and then evaporated to dryness, ignited, extracted with 5 ml. 10% H_2SO_4, filtered, washed into a 100 ml. flask, and made up to the mark when cool.

To five other portions (10 grm.) of soil 100 ml. 1% citric acid containing quantities varying from 0.5 mgm. P_2O_5 to 4 mgm. P_2O_5 as KH_2PO_4 were added and treated in a similar manner. The results were as under :—

Table VII.

Soil Number	Parts per million P_2O_5			Per cent. P_2O_5 Fixed.
	Added	In Filtrate	Retained by Soil	
B. 267	nil	11		
	50	12	49	98
	100	15	96	96
	150	25	136	91
	200	30	181	91
	400	62	349	87

The remarks by Hance on experiments by Ayres are interesting in this connection. Whereas the lowest application (50 p.p.m.) resulted in an *increase of only 1 part p.m. of sol. P_2O_5 over the original soil,* the fixation per cent. figure is 98. The highest application (400 p.p.m.) *resulted in 51 p.p.m. more of sol. P_2O_5 remaining in the soil* yet this appears as an 87 per cent. fixation.

IX.—Phosphate Fixation Experiment Beater's Method (Modified).

The five samples of soil used in Experiment VI were treated as in Experiment VIII but at only two ranges of phosphate application. The results were as follows :—

Table VIII.

Soil Number	Parts per million P_2O_5			Per cent. P_2O_5 Fixed.
	Added	In Filtrate	Retained by soil	
D 534	nil	80		
	100	90	90	90
	400	100	380	95
D 888	nil	166		
	100	170	96	96
	400	175	391	98
D 1885	nil	125		
	100	125	100	100
	400	137	388	97
NWCPI	nil	112		
	100	119	93	93
	400	125	387	97
NWCPXXVII	nil	nil		
	100	nil	100	100
	400	nil	400	100

X.—The Inorganic and Organic Fractions of Soil Phosphorus.

Determinations of Inorganic and Organic P_2O_5 were made on the five soils studied in Experiments VI and IX, and seven other topsoils of a pegassy type, using the method by R. W. Pearson (Iowa) in *Indust. Eng. Chem. Anal. Ed.*, Vol. 12, No. 4, pages 198-200 (1940). The results appear in Table IX.

TABLE IX.

Soil Number	Soil Type	Parts per million P_2O_5			P_2O_5 Fixation % From Table V.
		Inorganic	Organic	Total	
D 534	Clay	650	290	940	66
D 888	Pegassy clay	700	300	1,000	40
D 1885	Clay	650	150	800	62
NWCPI	Pegasse	450	1,070	1,520	40
NWCPXXVII	Lateritic clay	125	75	200	90
E 555 Vergenoegen S.	Pegasse	600	800	1,400	—
E 557 S. of Philadelphia	„	500	680	1,180	—
D. 2003 Diamond 66 G.G.	Pegassy Clay	900	770	1,670	—
Diamond 52 Woerden E	„ „	400	550	950	—
Diamond 56 Newland S. of Woerden E.	„ „	400	350	750	—
Diamond 58 Newland S. of Prosperity W.	„ „	500	350	850	—
Diamond 60 Newland S. of Prosperity E.	„ „	400	350	750	—

It will be noted that the inorganic P content of the first three samples, although from soils on different estates (*viz.* Versailles, Uitvlugt and Leonora) is remarkably constant, and the differences of the organic fraction are rather more striking. The pegasse soil from the North West District contains an abnormal amount of organic P, while the P level of the lateritic clay from the same district is very low in both fractions.

XI.—PHOSPHATE FIXATION AT DIFFERENT REACTIONS.

20 grams of a clay soil were shaken for one hour, with 100 ml. water, allowed to stand overnight and filtered on a Buchner funnel, pouring back until filtrate was clear, and P_2O_5 determined in the filtrate.

20 grams of soil were shaken with 100 ml. water containing 20 mgm. P_2O_5 as KH_2PO_4 and treated as above.

20 grams of soil were shaken with 100 ml. water containing 20 mgm. P_2O_5 and varying amounts of $\frac{N}{10}$ HCl, $\frac{N}{10}$ NaOH and lime water and the pH and P_2O_5 in filtrates determined.

The results appear in Table X.

TABLE X.

Treatment of Soil D 534	pH of Filtrate	Parts per million P_2O_5		
		Added	In Filtrate	Retained by Soil
Water only	4.50	nil	nil	
Water + P_2O_5	4.21	1,000	39	961
Water, P_2O_5 + 10 ml. $\frac{N}{10}$ HCl	3.08	,,	21	979
,, ,, + 20 ml. $\frac{N}{10}$ HCl	2.57	,,	25	975
,, ,, + 40 ml. $\frac{N}{10}$ HCl	2.03	,,	31	969
,, ,, + 10 ml. $\frac{N}{10}$ NaOH	5.67	,,	50	950
,, ,, + 20 ml. $\frac{N}{10}$ NaOH	6.94	,,	55	945
,, ,, + 40 ml. $Ca(OH)_2$	5.13	,,	11	989
,, ,, 80 ml. $Ca(OH)_2$	6.96	,,	10	990

It is interesting to note the relatively high fixing power of this soil even with such a high application of soluble P_2O_5 as 1,000 p.p.m. Under the conditions of the experiment the addition of lime caused more P_2O_5 to be fixed than was the case with untreated soil.

The following table shows the available P_2O_5 in soil taken from different depths in the same field.

TABLE XI.

Plantation and Field	Soil No.	Depth	Truog P_2O_5 (Initial)	% P_2O_5 fixed from 500 p.p.m. added
Uitvlugt 30 W (pegasse)	D 685	0–6″	220	44
	D 687	12–18″	20	42
Providence N.D.P 32	B 70	0–6″	80	52
	B 71	6–12″	nil	52
	B 72	0–6″	80	52
	B 73	6–12″	nil	66